

**Guide to
Resource Conservation and
Cost Savings Opportunities
in the
Adhesives, Paints & Coatings Sector**

ACKNOWLEDGEMENT AND DISCLAIMER

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**MINISTRY OF ENVIRONMENT AND ENERGY
A SECTOR STUDY OF ADHESIVES AND
PAINTS & COATINGS INDUSTRIES**

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I1: GLOSSARY

1.0 EXECUTIVE SUMMARY

The Industry Programs Branch (IPB) of the Ontario Ministry of Environment and Energy (MOEE) has commissioned a study of the Adhesives and Paints & Coatings (APC) industries with the objective of identifying key opportunities for improvements in efficiency, energy, water and material usage, and reductions of environmental releases at source by Stone & Webster Canada Limited (SWCL) and Shapiro & Associates (S&A). The information used was obtained from a variety of sources. These included Statistics Canada, MOEE and Ministry of Economic Development and Trade (MEDT). Additional data was obtained from various reports published by US Environmental Protection Agency (EPA), and "The Rauch Guide to the US Paint Industry", the "Review of Adhesives, North America" in Chemical Marketing Reporter, November 1993 along with other trade publications.

The data was supplemented with visits to eight Ontario APC plant locations to obtain first hand data on water and energy usage, as well as environmental release data.

Review of data by SWCL/S&A has revealed the following findings:

1. Energy, Water and Material Usage

The energy and water costs of the APC industries are a small percentage (1-2%) of the total production costs.

The main areas for savings in energy and water are associated with process heating and cooling and with the cleaning operation. The use of chillers or cooling towers would result in the recycling and reuse of

cooling water. The use of high pressure jets in the cleaning process would significantly reduce the volume of cleaning liquids required. Further savings could be achieved by the optimization of the batch manufacturing processes.

The field data on energy and water use from APC company visits is summarized in Table 1.

TABLE 1
QUANTITIES AND COST
OF ENERGY & WATER USAGE IN APC INDUSTRIES

Company's Annual Production	▸ 2 to 30 million litres per year.
Product Type	▸ Water borne and solvent borne consumer and industrial adhesives and paints and coatings
Total Water Usage	▸ 3 to 120 million litres per year.
Cost of Water (per kg of product)	▸ 0.03¢ to 1¢
Annual Energy Consumption	▸ 950 to 3,200 megawatt hours. ▸ 0.2 to 18 million cubic metre natural gas.
Cost of Energy (per kg of product)	▸ 1.2 to 12¢

Due to the fact that the field data is quite variable, the following observations can be made:

- a) The majority of companies in the APC industries have not traditionally collected or compiled data on their water usage. Thus the data that was obtained in the course of site visits may be

inadequate for the purpose of estimating total industry usage.

- b) Data available from other sources, e.g. Industrial Energy Services Program (IESP) on water usage by various sectors indicates that in large users of water, annual consumption can exceed 100 million litres/year.
- c) Caution must be exercised in extrapolating the water data presented in this report to other individual plants or industry averages of the APC industries.

Furthermore, the Industrial Energy Services Program study on Ontario's industrial sector (1987-1992) identified seven main classes for study of energy savings. They were, in order of importance,

1. Process
2. Electrical
3. Combustion
4. Space Heating, Ventilation and Cooling
5. Steam Systems
6. Scheduling and Energy Management Systems, and
7. Miscellaneous Items

More accurate data for water and energy usage should therefore be collected and compiled because indications are that there may be significant cost savings and conservation opportunities in this area.

Raw materials represent the single largest production cost component in the APC industries, accounting for

47-48% of the value of shipments. Raw material "losses" in the APC industries are reported to be in the order of 2-3% of total raw material purchased. These occur from a variety of sources during storage, handling, processing and filling. A large amount of these losses is due to materials left behind on surfaces of the manufacturing equipment. This latter item results in the need for improved cleaning operations.

To significantly reduce materials left behind in the equipment and process lines, a number of European APC companies, one Mexican and one Canadian Paint Manufacturing company are successfully recovering substantial amounts of raw materials along every step of the manufacturing process by meticulously scraping the sides of vessels and by using a pneumatically driven "pig" to clean out process lines prior to cleaning. The recovered material is returned to production. The result is both, reduced cleaning requirements and production cost savings.

A disposal problem exists with the non-returnable containers and packaging in which many raw materials are delivered to the sector manufacturers and which account for about 6% of the value of shipments (or \$100 million in 1991). Reduction in these could come from supplier and user cooperation.

A "check list" identifying the APC process areas that offer potential savings is presented in section 4.3.4 Efficiency Opportunity Audits, for guidance on energy, water and material usage and reductions in environmental releases.

2. Reduction of Environmental Releases

The key environmental concerns for the sector may be grouped as follows:

- a) Product
- b) Air Releases
- c) Liquid Releases
- d) Solid Releases

a) *Product*

The important trend of product stewardship is encouraged by various existing voluntary programs, such as the Federal Government Eco Logo and Canadian Chemical Producers Association (CCPA) Responsible Care Program. In addition, the Canadian Paint and Coatings Association (CPCA) has been evaluating initiatives in the area of Product Stewardship on behalf of its members. In one instance, a paint manufacturer has introduced its own program to collect unused architectural paint and reprocess it into other paint products.

b) Air Releases

The major releases to the atmosphere are volatile solvents and dusts. While the APC industries do not at present keep records of these releases, an Environment Canada study provides an estimate of the amount of solvent releases in 1985 (Table 2).

TABLE 2
ESTIMATE OF SOLVENT USAGE IN THE APC INDUSTRIES IN 1985

Solvent Type	Paints & Coatings	Adhesives
	(kt/yr)	(kt/yr)
Hydrocarbons	134	24
Other	53.5	10.9

Solvent losses during manufacture vary from 0.2% to 2% of the solvents employed. One company interviewed had solvent losses of about 2% in 1992 but had instituted procedures such as ensuring that equipment is enclosed and lids are used. While the majority of the solvent losses were in the form of hazardous liquid wastes, some solvent was lost through evaporation to air.

More accurate data for solvent losses should be collected and compiled because indications are that there are reasonable conservation and cost savings opportunities in this area.

c) Liquid Releases

Most of the liquid waste is generated in the process of cleaning of various units of equipment used for batch processing.

The use of counter current rinsing sequence in the washing process helps to minimize the generation of liquid effluent. Some companies are doing an efficient job in this area.

d) *Solid Releases*

The solid releases are largely made up of non-returnable packaging and containers.

Some hazardous solid waste includes non-returnable drums and "sludges" from waste water treatment or from cleaning solvent recovery distillation processes.

3) New Products

New product development over the past decade and plans for the future are mostly driven by environmental concerns. New products are aimed at lower Volatile Organic Compounds (VOC) content as well as lower toxicity, and property enhancements. The main beneficiary of these changes is the APC end-user, because it is estimated that 96-98% of VOC emissions occur at end-user locations. Product developments to date indicate no significant savings in water or energy consumption at the manufacturing sites.

4) Process Developments

New technologies to treat and recycle liquid/solid waste streams will continue to be developed. One example is the use of membranes to remove materials from waste water.

Although Computer Aided Manufacture (CAM) is not extensively used by these industries, it will become more common in resin manufacture and mixing/dispersion areas.

Production efficiencies could come from improvements in heat transfer efficiency and from cleaning equipment designs (for effective recovery of raw materials from process equipment).

Improved manufacturing management systems, that monitor product sales, inventories, and raw material purchases, will also improve productivity.

5. Application to Other Industries

The results of this study are applicable to other industries which handle many raw materials and use batch processes. The formulated products/specialty chemicals sector is a good area of potential application.

The aforementioned (item 2a) paint manufacturer's initiative in Product Stewardship, in the recycling of unused house paint should be a good example of what is feasible in the area of recycling. Conversely, the practices of equipment cleaning in the food industry should be applicable to the APC sectors.

The strong role of the Canadian Paints and Coatings Association (CPCA) has benefited the industry, especially in the area of communicating information on environmental regulations and issues. This model should be used in the other industries.

Conclusions and Recommendations

1. The companies visited during the course of this study have indicated their approval of MOEE's initiative on this study. MOEE should proceed with its plans for the Green Industry analysis and retrofits for the APC industries to identify and implement reduction opportunities in energy and water use and environmental releases.
2. A goal of 10-15% savings of total energy costs should be established and should be reasonably achievable. The total Canadian energy cost for these industries is \$18-19 million/year.
3. A goal of water savings and reduction of environmental releases should be tied to the reduction of raw materials and product losses. The savings in material losses are estimated at \$15-20 million a year for APC sector. Water savings of 30%/year, of total usage, should be possible.
4. This study, together with the earlier work done under the Industrial Energy Services Program (IESP), should become the basis for an advocacy/advisory package offered to industry associations, member companies and other government agencies related to the Chemical Sector.
5. MOEE should communicate the Green Industry initiative through industry associations, trade magazines, industry seminars and training of industry personnel.

2.0 INTRODUCTION

The Ministry of Environment and Energy (MOEE) has commissioned a study of the Adhesives and Paints & Coatings Industries (APC) in Ontario in order to identify key opportunities for efficiency and improvements in: energy, water and material usage and reduction of environmental releases at source (see the Terms of Reference in Appendix A). The exploitation of such opportunities will enable industrial operations to reduce operating costs and thus become more competitive in the global market place. It will also serve some of the primary objectives of the MOEE which are to foster a growing economy, energy and water conservation and a cleaner environment in Ontario.

Stone & Webster Canada Limited (SWCL) and Shapiro & Associates (S&A) carried out the study on behalf of MOEE. The information used was obtained from a variety of sources. These included Statistics Canada, MOEE and Ministry of Economic Development and Trade (MEDT). The data from MOEE was on energy efficiencies associated with a number of areas, but largely excluded the energy and water efficiencies of the manufacturing process of the APC industries. These savings relating to process aspects are illustrated in this study. Additional data was obtained from site visits to Ontario APC plants, various reports published by US Environmental Protection Agency (EPA) and various trade publications, "The Rauch Guide to the US Paint Industry", the "Review of Adhesives, North America" in Chemical Marketing Reporter, November 1993.

The resulting document, together with the earlier work done under MOEE's Industrial Energy Services Program (IESP), is intended to become the basis for an advocacy/advisory package offered to industry associations, member companies and other Government agencies related to the Chemical Sector.

3.0 OBJECTIVES

The purpose of this study is to provide the MOEE with a clear and concise report outlining the following five topics relating to the APC industries. The Terms of Reference for this study are attached in Appendix A:

1. *Sector Profiles* - Economic status, energy, water and resource usage, cost of energy/water per unit of production, infrastructure needs and usages and environmental pressure points.
2. *Generic Scope of Work* (process and product technology currently in use in Ontario) - Main types of processes involved, process and equipment that should be examined to identify the main opportunities for conservation and efficient use of energy/water and environmental pressure points.
3. *Key Efficiency Opportunities* (state-of-the-art process and technology currently in and outside of Ontario) - A brief description of commercially available equipment, technologies and management systems and practices that can be accessed today by companies in the APC industries. An indication of savings and improvements that can be achieved immediately or over a short period (up to five years) is required.
4. *New Technologies* (process and product technology under development in and outside Ontario that could be available in 5 to 10 years) - A review is required of the efficiency of energy and water usage and environmental release reduction technologies that will

be applicable to the APC industries in the next 5 to 10 years.

5. *Applicability to Other Industries* - A review of items that may arise from 2, 3 and 4 above that may apply to other manufacturing sectors.

4.0 DISCUSSION

4.1 Sector Profile

Canadian APC sectors generated in 1991 shipments of \$1.7 billion (\$1.1 billion in Ontario) and employed about 9800 people (about 6500 in Ontario). The Statistics Canada data for shipments, establishments, employees, and exports/imports is summarized in Table 3.

TABLE 3
1991 STATISTICS CANADA DATA FOR THE APC INDUSTRIES

	Adhesives Sector	Paints & Coatings Sector	Total
Number of establishments in Canada (Ontario)**	48 (39)	129 (67)	177 (106)
Value of shipments Canada (\$ million) (Ontario)**	303 (242)	1,370 (860)	1,673 (1,102)
Number of employees in Canada (Ontario)**	2,346 (1,800)	7,494 (4,600)	9,840 (6,400)
Imports (\$ million)	65*	258	323
Exports (\$ million)	15*	42	57
Trade surplus (deficit) (\$ million)	(50)*	(216)	(266)

* Estimated to be half of Adhesives and Sealants reported by Industry, Science & Technology Canada (ISTC) for 1988.

** Number in bracket represents Ontario data.

1991 Statistics Canada data for manufacturing industries in Canada indicated that the Chemicals Sector was at third place, at \$21.3 Billion of shipments, behind Transport (\$48 Billion) and Food (\$38 Billion). The APC industries at \$1.7 Billion, represent 8% of the Chemical Sector.

The APC Industries are part of the Formulated Products and Specialty Products sub-sector of the Chemicals sector. In 1991, the APC industries in Ontario had combined shipments of \$1.1 Billion, representing 21% of the \$5.2 Billion of shipments of the Formulated Products and Specialty Products sub-sector and 7.7% of the estimated \$14.2 Billion of shipments of the Chemical Sector in Ontario.

The data above are detailed in Appendix B.

Unlike the chemical sector, which typically uses continuous processes, sophisticated process control, and is capital intensive, the APC sectors use batch processes, are more labour intensive and generally use less sophisticated process control and instrumentation technology. As a result, major efficiency opportunities in these sectors are found to be in maximizing the yield from raw materials used and in improving the process of cleaning of various equipment units that are used in batch processes. Initiatives of process optimization by technique such as Statistical Process Control (SPC) are found to be relatively un-common in the APC industries and should be further investigated.

4.1.1 Adhesives

Adhesives are formulated by mixing a base resin with fillers, pigments, stabilizers, plasticizers and other

additives to yield desired end-use characteristics at a suitable cost. Low to medium performance products are based on natural resins or synthetic resins such as polyvinyl acetate, polyesters and acrylics. High performance products are based on resins such as epoxy, polyamide, polysulphide, polyurethane and silicones. More than 60% of the products are waterborne.

There are 48 establishments making adhesives in Canada, with 39 of these companies in Ontario. In 1991, the sector employed 2,346 people and shipped \$303 million of products. In 1991, this sector is estimated to have had a trade deficit of about \$50 million with the USA (see Table 3).

In response to customer requirements, which are reflecting a greater awareness of volatile organic compound (VOC) emissions at the application site, the industry is formulating more of its products towards having lower content of volatile solvents. This generally means more waterborne or higher solids products and more solvent free products, such as hot melts.

Of the major producers of adhesives (see Appendix C1), two thirds are foreign owned. The breakdown by size of the 48 Canadian producers is summarized in Table 4:

TABLE 4
ADHESIVES PRODUCERS GROUPED BY SALES

% of Producers (Number of Producers)		Sales \$/Year (1991)
Major	4% (2)	> \$25 Million
Medium	33% (16)	\$5-15 Million
Small	61% (30)	< \$5 Million

Typically, the larger producers make resin to meet a portion of their own needs. Smaller producers usually buy all their resin requirements. Both, large and small producers, purchase significant resin quantities.

Raw materials and supplies represent a large component (45-55%) of the value of shipments. Non-returnable containers and packaging represent 6-7% of the value of shipments (see data in Table 6).

4.1.2 Paints and Coatings

Paints & Coatings, like Adhesives, are formulated by mixing resins with pigments, fillers, stabilizers and additives to yield a product with desired end-use properties at a suitable cost. Because colour is a major factor in the manufacture of paints & coatings, the manufacture of these products, unlike Adhesives, frequently requires a considerable amount of energy to disperse pigments using specialized equipment.

Paints & Coatings consist of two segments, each of about equal size: architectural paints (sold directly to consumers and to paint contractors) and industrial coatings (sold to industrial customers for original equipment manufacture (OEM), can coatings, furniture finishes and other applications). Waterborne coatings represent about 65-70% of architectural paints and 15-25% of industrial coatings.

While some major paint manufacturers make their own synthetic resin, the majority of resin is supplied by chemical producers. Manufacture of resins is more prevalent in the industrial coatings segment of the industry where the resin products may be patented.

In response to customer needs, which are reflecting stricter environmental control concerning VOC emissions, the industry is formulating its products toward having lower content of volatile solvents. This means higher solid coatings, waterborne coatings and solvent free coatings such as powders (which are made from solid resins). The benefits of lower VOC occur mainly at the customers' facility with minor benefits at the APC manufacturing location.

There are about 129 establishments in Canada that manufacture paints and coatings, with more than 50% located in Ontario. The top 50 manufacturing companies account for 90% of the domestic production. The remaining companies 70 are quite small averaging \$2-3 Million in annual sales.

In 1991, this sector shipped \$1.37 billion of products and employed 7,494 people. In 1991, imports of Paints and Coatings were \$258 million while exports were \$42 million, resulting in \$216 million trade deficit.

Appendix C-2 lists 15 (or 12% of all) major paint companies, with two thirds being foreign owned, that account for over 50% of total shipments by this sector.

Raw materials represent the single largest cost component in this industry, accounting for 47-48% of the value of shipments. Non-returnable containers and packaging account for about 6% of the value of shipments, or \$80 million in 1991. Labour costs represent 7-8% of value of shipments see data in Table 6).

4.1.3 Impact of Free Trade Agreement (FTA) and North American Free Trade Agreement (NAFTA) and Competitive Position of APC Sectors

Even without FTA and NAFTA, the industry needs to address rapidly rising customer expectations, particularly industrial customers, for greater product quality and higher levels of service in the form of ISO 9000 certification and various quality improvement initiatives, such as, Statistical Process Control (SPC), "Just-In-Time" delivery and general involvement of all employees in concepts of "Total Quality Management" (TQM).

The main impact of FTA and NAFTA is to expose the APC sectors that had, until 1988, operated with the support of substantial import tariff barriers, to much greater competition.

Six years of FTA have led to numerous closures of operations that are no longer competitive with US plants. On the positive side, substantial investments have been made by Canadian and foreign owned companies in modern, state-of-the-art manufacturing facilities to supply North American customers from Ontario locations.

Canadian manufacturing plants are, on average, smaller than US plants and are generally geared toward the manufacture of smaller batches. In addition to lower labour productivity in Canada resulting from smaller batches, there are higher costs associated with each batch due to higher prices for smaller quantities of raw materials, higher losses due to the larger numbers of smaller batches, duties (currently declining) and greater freight expenses for imported raw materials. There are also indirect cost advantages for the larger, multi-plant, multi-national manufacturers from the perspectives of marketing, R&D and centralization of administrative functions.

Another competitive issue for the APC industries is in formulating technology. R&D expenditures in Canada, as a percentage of sales, are about one-half of what they are in the USA (2.7% for the USA Paints and Coatings Sector). This is mitigated somewhat by the fact that a significant number of major companies in Canada are foreign owned and they rely on their parent companies for technology support. However, the profile of a typical Canadian owned manufacturer in the APC sectors is that of a small to medium sized enterprise (SME), relying largely on suppliers of resins and other raw materials for formulation technology. This source of technology has been slowly eroding as chemical suppliers reduce the level of service that they can afford to offer to the APC sectors.

These topics are covered in detail in Appendix D1 in an article by Shapiro, C.H. Kaufmann and I.H. McEwan, "Exploring the Competitiveness of Canada's Paint Industry", in COATINGS Magazine November/December 1992. The comments also apply to the Adhesives Industry.

4.1.4 Energy, Water and Resource Usage in APC Sectors

During this study, six Paint and Coatings companies, which represent approximately 20% of Ontario's production in this sector, were visited and interviewed. In addition, two major adhesives manufacturers were visited and interviewed. The two adhesives manufacturers together with a third adhesives producer, whose data was available from MOEE's IESP program, represent approximately 25% of Ontario's APC production. All companies visited welcomed the opportunity for this type of analysis with the expectation of significant benefits to their companies.

4.1.4.1 Water Usage

Process water is used in the Adhesives and Paints & Coatings industries for cooling and cleaning. The use of water varies greatly depending on individual circumstances. For example, one large producer of architectural paints and sealants uses 2.5 million litres/year of water in products and operates a plant with virtually 'zero' liquid effluent. This producer uses only 1/10 of the volume of water in products for process water. On the other hand, an important producer of Adhesives, interviewed during the course of this study, uses 120 million litres/year of process water.

The field data from company visits is summarized in Table 5 for energy and water usage and for environmental emissions. The data was quite variable so ranges were provided and the following observations must be made:

- a) The majority of companies in the APC industries have not traditionally collected or compiled data on their water usage. Thus, the data that was obtained in the course of the visits, are inadequate for industry projection.
- b) Data available from other sources (i.e. an IESP program on water usage by various sectors) indicates that with large users of water annual consumption can exceed 100 million litres per year per company.
- c) Caution must be exercised in extrapolating the data presented in this report to other plants or to generate APC industry averages.
- d) It is recommended that more comprehensive data for water and energy usage be collected and compiled as the indications are that there may be significant cost savings and conservation opportunities in this area.

4.1.4.2 Energy Usage

Data generated by company visits is summarized in Table 5. Energy usage, like water usage, varied depending on individual circumstances. As with the water usage, this data must be used with caution. By using high and low ends of energy data ranges, an estimate of energy consumption was made. The cost in cents/kg of product varied from 3.2¢/kg to 5.3¢/kg (average of 4.3¢/kg) and the total industry energy cost varied from \$13.6 million to \$22.5 million (average of \$18.1 million). This translates to 260 million kilo-watt-hours (KWH) of consumed energy. These figures compare well with figures from Statistics Canada.

TABLE 5
FIELD DATA ON ENERGY AND WATER USAGE AND ENVIRONMENTAL DISCHARGES

<u>FIELD DATA - ADHESIVES AND PAINTS AND COATINGS INDUSTRIES, ONTARIO</u>	
Company's Annual Production*	2 to 30 million litres per year.
Product Type	Water borne and solvent borne consumer and industrial adhesives and paints & coatings.
Total Water Usage ** ***	3 to 120 million litres per year.
Cost of Water (per kg of product)*	0.03¢ to 1¢
Annual Energy Consumption**	950 to 3,200 megawatt hours. 0.2 to 18 million cubic metre natural gas.
Cost of energy (per kg of product)**	1.2 to 12¢
Cost of Non-Hazardous Waste Treatment or Disposal (per kg of product)*	0.15¢ to 1¢
Cost of Hazardous Waste Disposal (per kg of product)*	0.4¢ to 4¢
Air Emissions Data	Generally not available.

Legend:

- * Data provided by companies visited.
- ** Estimated based on information on unit cost or consumption per kg of product provided by companies visited.
- *** Ratio of process to product water usage ranges between 15-20 to 1 based on industry source estimates. The actual field data ranged from 1-28 to 1.

4.1.4.3 Resource Usage

For the purposes of comparison and reference, Table 6, on the next page, shows a data profile, provided by Statistics Canada for both the Adhesives and Paint & Coatings industries. The profile includes: employers, fuel, raw materials, non-returnable packaging and estimates of material losses during manufacture.

TABLE 6

Manufacturing Inputs	1988	1989	1990	1991
Paint and Coatings (SIC 3751)				
Number of Establishments	151	146	140	129
Number of Employees	8404	8639	8331	7494
Cost of Production Labour (\$ millions)	117	123	119	104
Cost of Fuel & Electricity (\$ millions)	15.5	14.7	15.1	13.9
Cost of Raw Materials (\$ millions)	710	678	612	578
Cost of Non-Returnable Containers and Packaging Materials (\$ millions)***	104	100	90	80
Value of Shipments (\$ millions)	1660	1660	1494	1371
Water Usage in Product (million litres)*	64	71	66	63
Raw Material Losses During Processing (\$ million) Estimated 2-3% of Total	17	17	15	14
Adhesives (SIC 3792)				
Number of Establishments	44	49	46	48
Number of Employees	1214	1347	1416	2346
Cost of Production Labour (\$ millions)	17	21	21	37
Cost of Fuel & Electricity (\$ millions)	2.5	2.4	3.0	4.7
Cost of Non-returnable Containers and Packaging Materials (\$ millions)***	14	15	13	20
Cost of Raw Materials (\$ millions)	101	114	99	121
Value of Shipments (\$ millions)	207	228	208	303
Water Usage in Product (million litres)**				29
Raw Material Losses During Processing (\$ million) Estimated 2-3% of Total	2.5	3	2.5	3

* Calculated from Statistics Canada report 46-250 using quantities of aqueous paint produced and the assumption that 50% of waterborne paint is water.

** Chemical Marketing Reporter (CMR) November 15, 1993 reports the world adhesives market at US \$16.3 Billion and 15.5 Billion pounds, resulting in an average price of US \$1.05/lb or Can \$3.17/kg. Water in product was estimated using this price, CMR's estimate that 60% of products are waterborne and the assumption that 50% of waterborne product is water.

*** Reported only by large and medium size establishments.

4.1.5 Environmental Pressure Points in APC Sectors

The key environmental concern areas are as follows:

1. Product
2. Air Releases
3. Liquid Releases
4. Solid Releases

Product

The nature of these industries is such that they produce hundreds of different products and purchase thousands of raw materials. Most products and raw materials are considered hazardous and are regulated through various Federal Acts viz:

1. Transportation of Dangerous Goods Act
2. Hazardous Products Act
3. Occupational Health and Safety Act (OHSA)
4. Workplace Hazardous Materials Information System (WHMIS)
5. Canadian Environmental Protection Act (CEPA)

The single largest concern of the industry, relates to restrictions placed on new product development that arise from CEPA and the regulations that affect the introduction of new products through the Designated Substances List (DSL). The additional costs associated with the testing and approval in order to place new products on the DSL are expected to impact negatively on these industries and to slow the introduction of new products.

The importance of formulation of new low VOC products has already been mentioned. Change is also encouraged through various voluntary programs, such as the Green Industry Program, federal government Eco Logo and Canadian Chemical Producers Association (CCPA) Responsible Care Program. In addition, Canadian Paints and Coatings Association (CPCA) has been evaluating initiatives in the area of Product Stewardship on behalf of its members. In one instance, a paint manufacturer has introduced its own program to collect unused architectural paint and reprocess it into other paint products.

The impact of potential new legislation to reduce VOC emissions from industrial and commercial (e.g., automotive OEM paint) coatings operations, being studied now by the Canadian Council of Ministers of the Environment (CCME), is well recognized by the industry. The Canadian regulations are expected to parallel those in the USA where industrial coatings are already formulated with the objective of meeting this type of regulation. It is anticipated that there will not be any difficulties in the Industrial Coatings manufacturing sector with manufacturing products to meet this type of legislation assuming that additional costs associated with CEPA's DSL can be dealt with.

Air

The major releases to the atmosphere are volatile solvents and dust. While the industry does not at present keep records of these releases, some estimates of solvent usage has been carried out for the CCME. Table 7 gives an estimate of 1985 solvent usage in these industries.

TABLE 7
1985 SOLVENT USAGE DATA

Solvent Type	Paints & Coatings	Adhesives
	(kt/yr)	(kt/yr)
Hydrocarbons	134	24
Other	53.5	10.9

Solvent losses during manufacture vary from 0.2% to 2% of the solvents employed. One company interviewed had solvent losses of about 2% in 1992 but had instituted procedures to reduce these. An adhesives producer interviewed during this study had solvent losses of 0.2%. While the majority of the solvent losses were in the form of hazardous liquid wastes, some solvent was lost through evaporation to air.

Airborne particulates are collected via cyclone or bag filters.

Liquid

Most of the liquid waste is generated in the process of cleaning of various units of equipment used for batch processing. This is discussed in more detail in section 4.2. Some liquid waste is generated from cleaning up spills and from off-specification product.

Solid (Non Hazardous)

This includes materials disposed by incineration, landfill, contract treatment and solid garbage.

Some solid waste is generated from non-returnable packaging materials and supplies used in the manufacturing operation.

The APC sectors also use about \$100 Million per year of non-returnable packaging materials which represents a disposal expense for their customers. Table 6 in section 4.1.4.3 provides an indication of the size of expenditures in this area. This subject is discussed in more detail in section 4.2 Generic Scope of Work for APC Sectors.

4.2 Generic Scope of Work for APC Sectors

The batch nature of the manufacture, by the APC sectors, involving a large number of raw materials and many products presents a challenge to implement further efficiency improvements through production processes and systems. There has been some movement to plants dedicated to a simple product range, in order to achieve efficiencies by this simplification.

Table 8 summarizes the major processing steps, in sequence, used by the Adhesives and the Paints and Coatings industries and indicates the relative importance of energy and water usage and environmental releases for each processing step. Because APC sectors deal with as many as twenty different raw materials in a typical formulation, materials handling is an important part of each processing step. Improved material handling methods can result not only in reduced losses of raw materials, but also in reduced requirements for energy and water.

TABLE 8

ENERGY AND WATER USAGE AND ENVIRONMENTAL RELEASES

Process Steps	A	P&C	Water	Energy	Releases to Environment		
					Solid	Liquid	Air
Resin Manufacture	x	x	•	•	o	o	o
Cleaning of Resin Kettle	x	x	•	•	o	o	o
Primary Dispersion (Paints only)		x	•	•	o	+	+
Cleaning of Fixed Primary Dispersion Equipment		x	o	o	o	+	+
Secondary Dispersion & Mixing	x	x	•	•	o	o	o
Cleaning of Fixed Secondary Dispersion and Mixing Equipment	x	x	o	o	o	+	o
Testing	x	x	None	None	None	None	None
Filtering, Filling, Labelling and Packing	x	x	o	o	o	o	o
Cleaning of Filling Equipment	x	x	o	o	o	o	o
Cleaning of Portable Equipment in a Dedicated Area	x	x	•	•	•	•	•

Legends: x Applies
 • Significant
 + Moderate
 o Minor

Exhibit C is a block flow diagram showing the various manufacturing steps.

Exhibit D is a mass balance for APC manufacture.

4.2.1 In-House Resin Manufacture

Resin manufacture is carried out in batch processes in large, 4000 litre or more, stainless steel kettles equipped

provided by metering pumps and piping. Ports are provided for solid additions and for sampling for quality testing. The raw materials (monomers) are loaded into the kettle where they are heated to 80° to 250°C to polymerize them to form resin. The resin is cooled prior to storage in holding tanks designed to reduce vapour emissions.

The kettles are usually cleaned by liquids that are subsequently reused and mixed with the main products prior to storage to reduce waste. Solvent or water/alkali cleaning is carried out occasionally. The waste liquids are handled as described in section 4.2.6.

Generally, energy and water cooling requirements are large in these operations and improvements in efficiencies can be obtained either through better instrumentation and control and/or by investment in additional heat exchange surfaces.

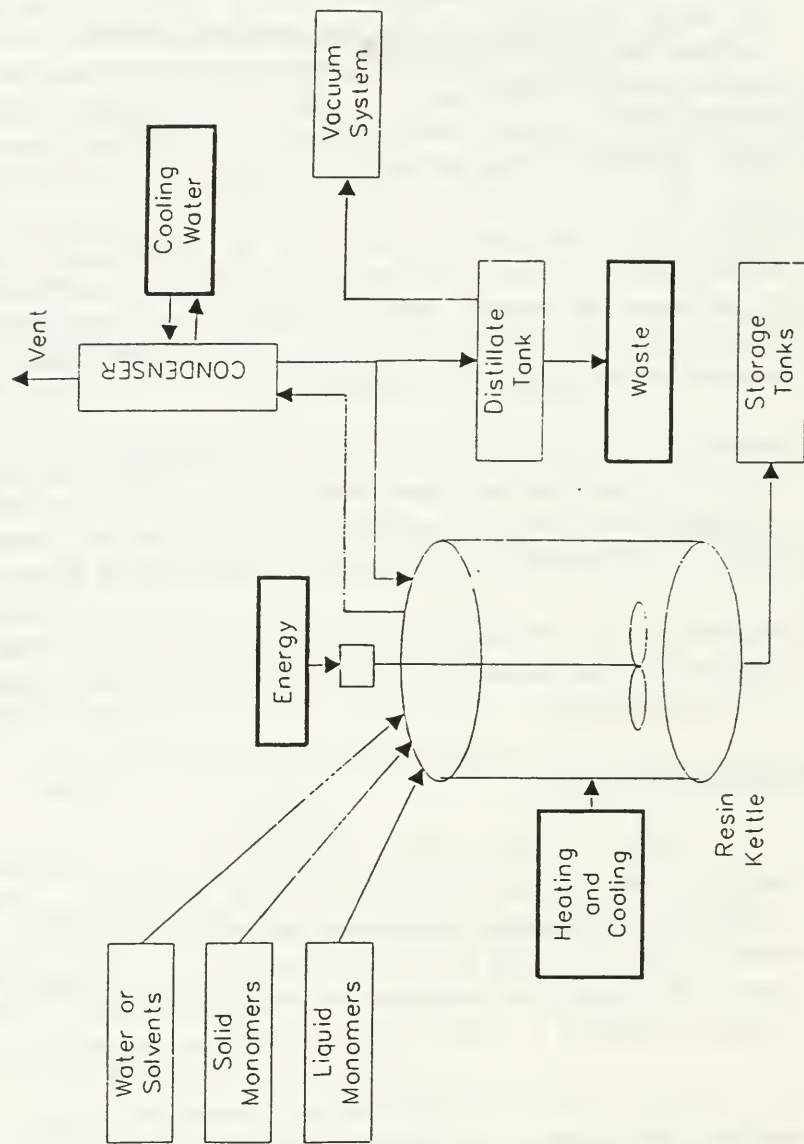
Exhibit A is a simple block flow diagram of resin manufacture and Exhibit B is a mass balance for typical resin manufacture.

4.2.2 Primary Dispersion

This process is used mainly by the Paint and Coatings industry for dispersion of coloured pigments. The "difficult to disperse" pigments, solvents and resins are added to ball or bead mills and dispersion is achieved by shear and impaction forces in a viscous medium. The dispersed pigment is stabilized to reduce re-agglomeration.

The cleaning of this equipment is very important because it enables the producer to minimize losses of expensive raw materials and ensures consistent quality of dispersion free

EXHIBIT A -- BLOCK FLOW DIAGRAM FOR RESIN MANUFACTURE



1. Cooling tower used to recirculate cooling water
2. Vapour traps used to reduce emissions
3. Water or solvent is used to clean equipment and added to the finished resin
4. Occasional cleaning of kettle.


```
graph TD
    RS[Raw Solids  
3 - 10%] --> T[TOTAL  
100 %]
    RL[Raw Liquid Monomer  
40 - 50%] --> T
    SW[Solvents/Water  
40 - 50%] --> T
    AC[Additives, Catalysts, etc.  
1 - 5%] --> T
    T --> RP((Resins Processing))
    RP --> FL[FINAL PRODUCT  
97 - 98%]
    RP --> LL[Loading Loss  
approx. 0.1 %]
    RP --> VL[Vapour Losses  
approx. 0.1 %]
    RP --> TLL[Transfer Line Losses  
0.8%]
    RP --> LFF[Losses from Filters  
1 - 2%]
    RP --> RLSS[Reactor Losses  
< 0.1%]
```

The flowchart illustrates the Resins Processing process. It begins with four input streams: Raw Solids (3 - 10%), Raw Liquid Monomer (40 - 50%), Solvents/Water (40 - 50%), and Additives, Catalysts, etc. (1 - 5%). These inputs combine to form a 'TOTAL' of 100%. This total then enters the 'Resins Processing' stage, represented by a cylinder. From this stage, the process results in a 'FINAL PRODUCT' (97 - 98%) and several loss streams: Loading Loss (approx. 0.1%), Vapour Losses (approx. 0.1%), Transfer Line Losses (0.8%), Losses from Filters (1 - 2%), and Reactor Losses (< 0.1%).

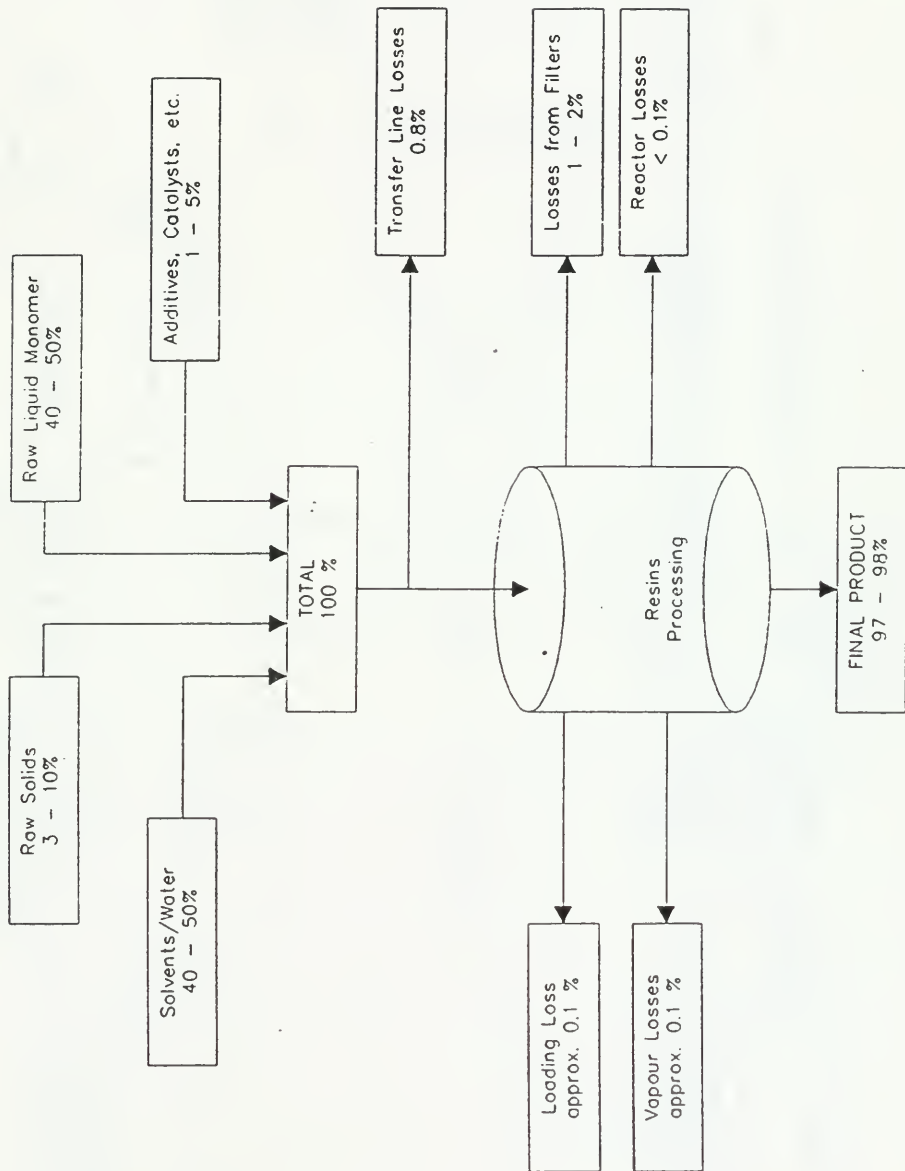


EXHIBIT C TYPICAL ADHESIVE AND PAINT MANUFACTURING PROCESS (BATCH)

NOTE

1. All units of equipment used in batch manufacturing are cleaned after use.

- (R) - release to the environment
 (E) - electricity
 (C) - cooling
 (H) - heating
 — - for pigmented coatings.
 - - - for adhesives only.
 — — — for both adhesives & paints and coatings.

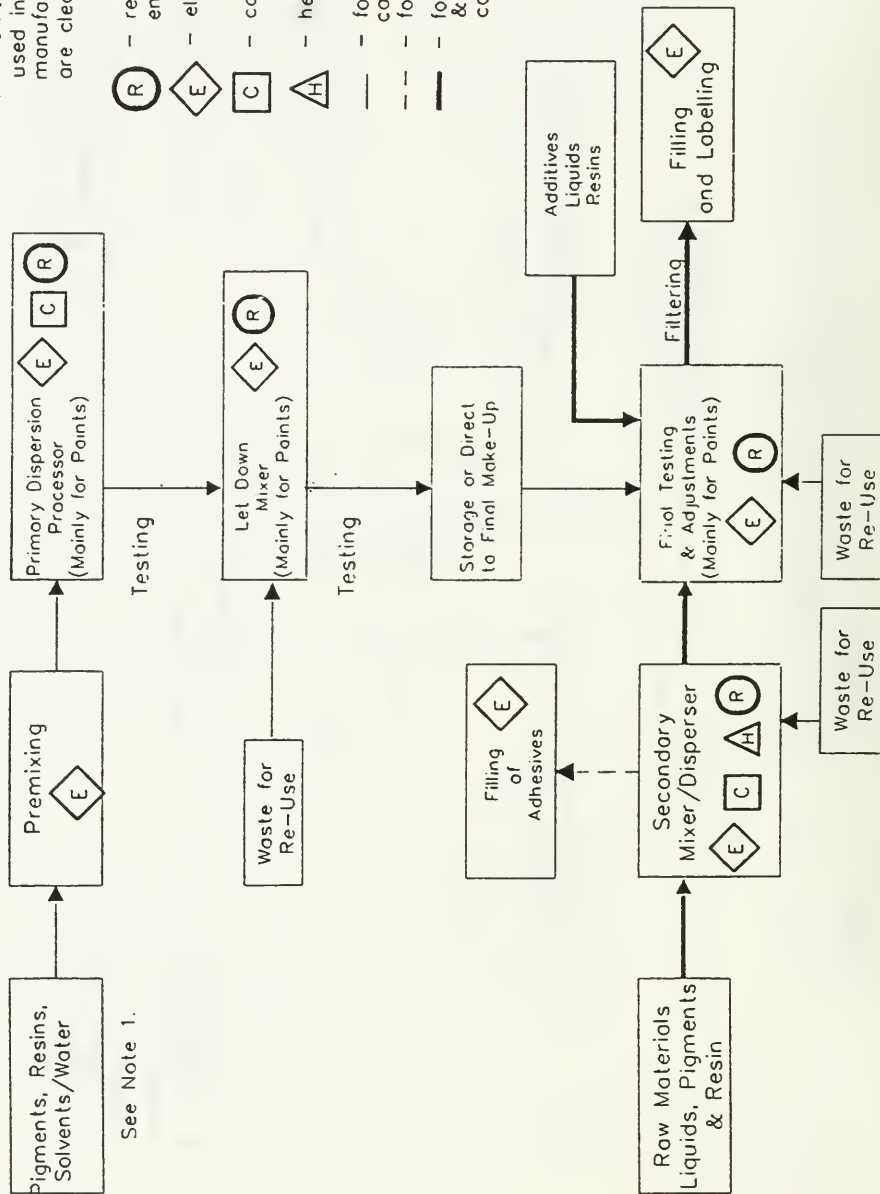
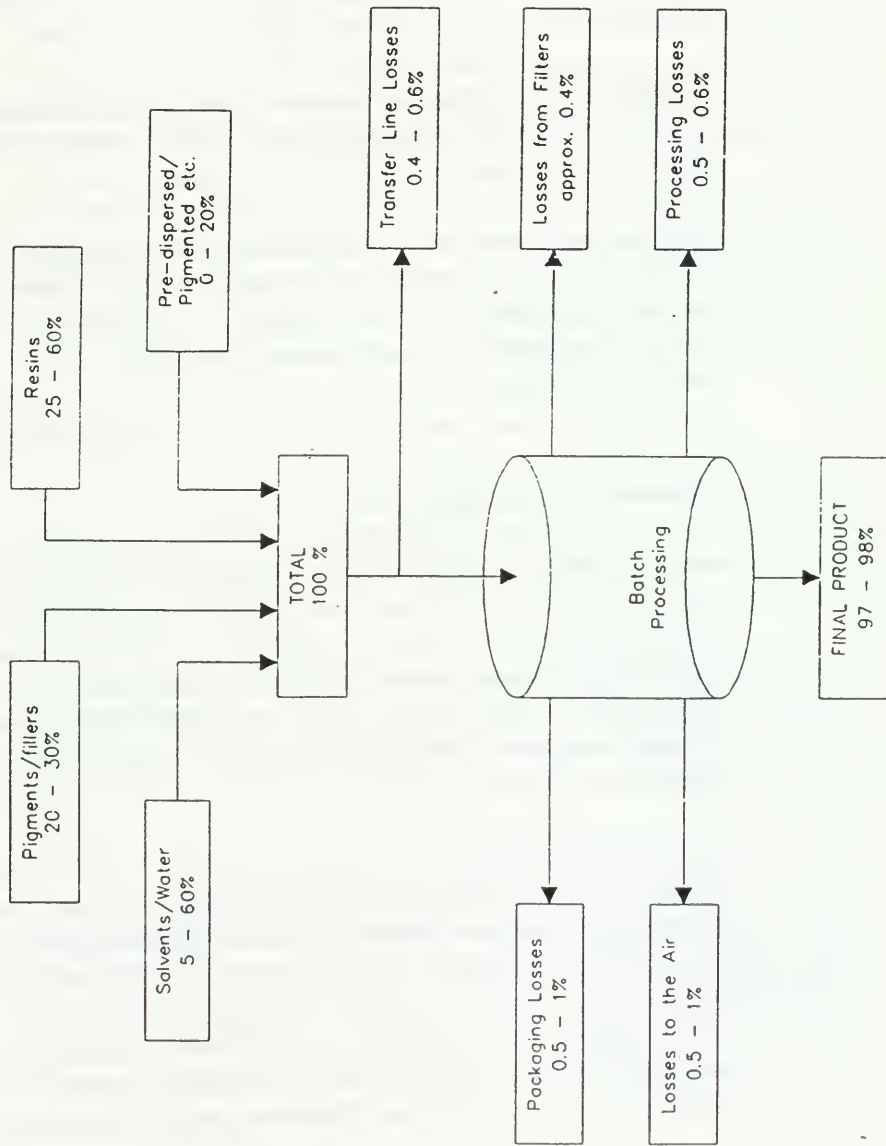


EXHIBIT D - EXAMPLE OF MASS BALANCE FOR THE ADHESIVES
AND PAINTS & COATINGS PRODUCTION AREA



from contamination from different coloured pigments. The cleaning liquids can be reused in products except where extensive dilution results in flocculation and settling of pigments.

Frequently, portable containers are used to feed materials to the dispersion units and to collect the end product. These are cleaned in a dedicated cleaning area.

The process uses high energy dispersion equipment, such as ball mills, sand mills, bead mills and attritor mills. Cooling is applied in some cases to control the loss of volatile vapours. Improvements in efficiencies can be obtained through better instrumentation, SPC, high efficiency motors, and other means indicated in section 4.3.

4.2.3 Secondary Dispersion/Mixing

The dispersion of pigments and fillers in this process step requires less energy than the primary dispersion process. This process step usually uses high speed motors with specially designed impeller blades, e.g., Cowles serrated blade, screw shaped blade, etc., to provide strong shearing forces to achieve dispersion/mixing. With Adhesives the product can proceed directly to filling after filtering.

In the Paint Industry, dispersion steps usually progress further to a relatively low speed mixer for final addition of materials such as resins, liquids, intermediate products and additives, and for final adjustments and testing.

In the Adhesives Industry, the vessels frequently have heating jackets to provide heating during processing of more viscous materials and use ribbon or screw type mixers and

then cooling prior to filtering and or filling. These units use substantial amounts of energy and cooling water.

Cleaning of stationary vessels is achieved with liquids that are used in the final product and can be reused unless the product is diluted too much. Sometimes portable containers are used. These are cleaned in a dedicated cleaning area.

The opportunities for energy and water savings may be smaller in this step compared to the primary dispersion step except where heating and cooling are used. Improved efficiencies may be found in improved mixer blade designs, high energy motors and better instrumentation and controls.

4.2.4 Testing

The testing of industrial products to customer specifications can take a relatively long time. In particular, colour matching of metallic colours in paints can be a long procedure.

The savings of time/tied up equipment may be achieved with modern colorimeters, viscometers, etc., and improved testing of raw materials and intermediate materials manufactured in-house.

4.2.5 Filling

The empty containers are conveyed to a station where they are filled by a multi-head filling machine. They then proceed to a labeller and to a case packer and palletizer before warehousing.

Modern packaging, labelling, palletizing equipment, if not already in use, would improve production efficiency.

4.2.6 Cleaning

Cleaning was identified as a key potential area for efficiency savings. This operation occurs during most stages of manufacture. Two main types of equipment require cleaning. They are fixed, such as tanks, process lines, dispersion equipment, etc. which are cleaned "in-situ" and portable units on wheels which are cleaned in designated areas.

The initial cleaning uses liquids employed in the final product so that they can be reused. Subsequent washing/rinse cannot be re-used if the materials are too dilute. In these situations, the dilute washings/rinse may have to be disposed of or recycled, by distillation in the case of solvent washings/rinse.

Any delay in cleaning can result in the product drying and presenting a more difficult cleaning problem

The two main cleaning mediums in use are solvents and hot alkaline solutions.

The traditional cleaning method has been to fill the vessel with hot aqueous alkaline solutions and clean by mechanical or manual brushing. This is followed by rinsing with large amount of water. Modern equipment designs reduce air emissions by enclosing the vessel to be cleaned, use sprays of solvent or hot aqueous alkali solutions, or, in some cases, high pressure jets. The final washing/rinsing is accomplished with large amounts of appropriate liquid.

Scraping of sides of vessels is generally carried out manually to reduce the amount of material on the vessel. Automated mechanical means are now available to do this.

The spent solvent is recycled through distillation, either on site or by a contractor. This process results in a final "sludge" of unstable paint or adhesive material that requires special disposal.

The spent aqueous alkaline wash is neutralized and the suspended solids reduced by settling (or in some cases by flocculation) prior to discharge. The soluble solids are not generally removed. The suspended sludge is disposed as Hazardous Waste.

Exhibit E is a block diagram of a dedicated cleaning area and Exhibit F is a Waste Management block diagram in an Architectural Paint manufacturing facility.

A detailed listing of APC Industry equipment and manufacturers/agents is presented in Appendix E.

4.3 Key Efficiency Opportunities

To date, MOEE has completed a study comprising eight energy audits in the Adhesives and Paint and Coatings industries (three in Adhesives and five in Paint and Coatings) as part of its Industrial Energy Services Program (see Appendix E). The total energy consumption for the eight plants is \$2.9 million. Energy savings that were identified represent \$300,000/year which is 10.4% of the total energy requirements for the eight companies. The savings came from waste heat recovery from utilities, services, lighting and from effluent streams. The savings could be achieved

EXHIBIT E -- BLOCK DIAGRAM FOR CLEANING

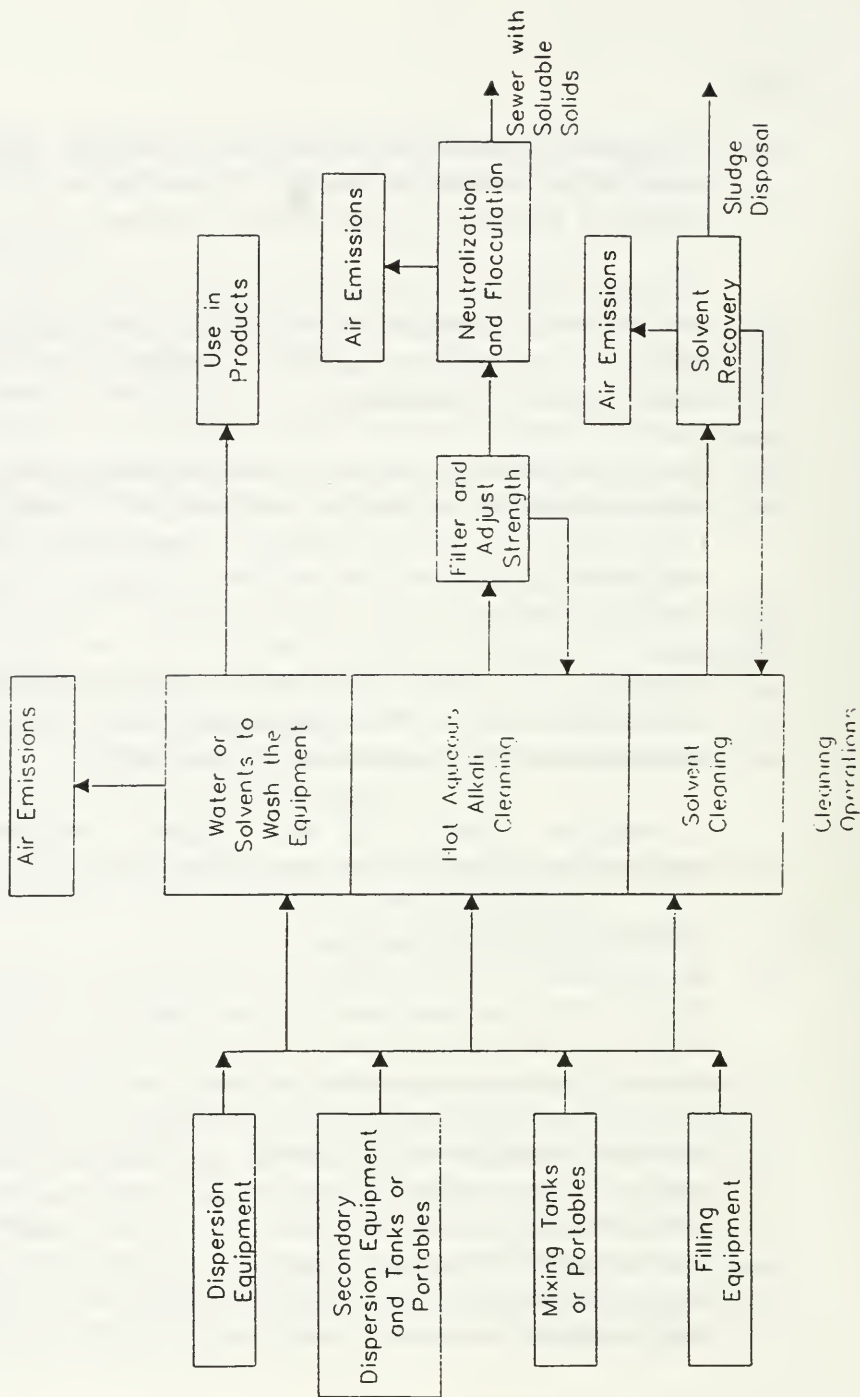
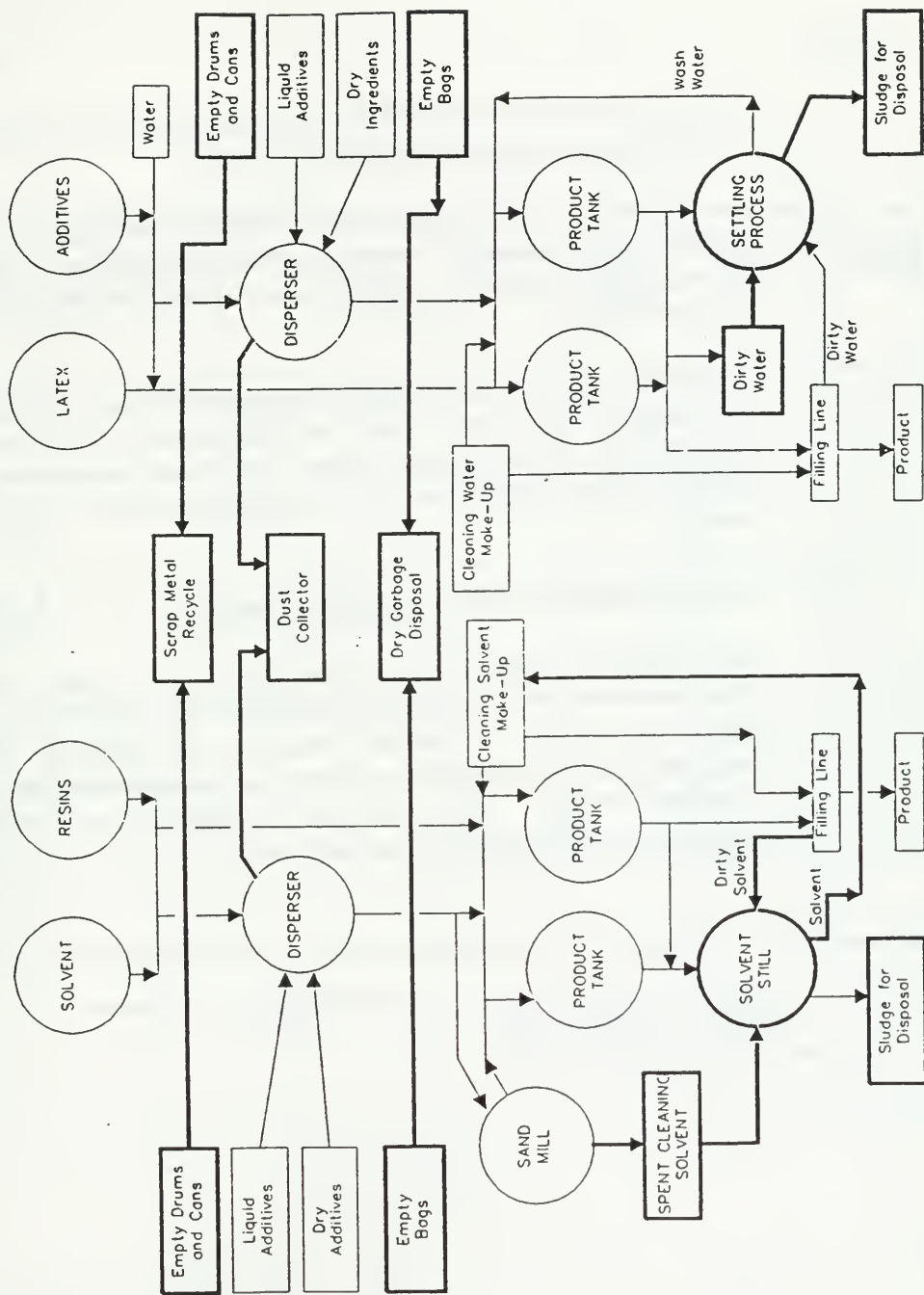


EXHIBIT F -EXAMPLE OF WASTE MANAGEMENT BLOCK DIAGRAM IN PAINT MANUFACTURE



through expenditures of \$610,000 resulting in a two year payback.

In addition, MOEE conducted a "Green" analysis of one Adhesives company which showed the potential of 36% savings of energy and water costs and a reduction of 44% of material losses.

The above and other data from the Chemical Sector (IESP Five Year Summary April 1987- 1992) are encouraging and indicate significant potential for energy and water efficiencies together with reductions of raw materials and waste at source.

4.3.1 Key Opportunities Energy and Water Savings

The following Tables 9 and 10 summarize where energy and water savings can be realized, provide an indication of comparative size of savings that can be achieved and indicate the costs associated with these savings by means of a payback period. The tables also indicate areas where equipment retrofitting may be applicable.

TABLE 10
KEY OPPORTUNITIES FOR WATER SAVINGS

Process Steps	Process Water Savings Opportunities	Use Chillers/ Cooling Towers	Reuse Cooling Water in Cleaning	Increase Recirculation of Cleaning Medium	Use First Rinse Water in Product	More Efficient Cleaning Equipment*	Improved Material Handling
Resin mfr.	•	+++ R			+++		++
Primary Dispersion	•	+++ R			+++		++
Secondary Dispersion/ Mixing	○				+++		
Testing	none						
Filling	○						
Cleaning	•		+++ R	+++ R		+ R	

Legend:

- - significant
- - minor
- +++ fast payback (< 1 year)
- ++ medium payback (1-2 years)
- + slow payback (>2 years)
- R Retrofitting potential exists

* -
-

Use ultrasonic energy to supplement or replace mechanical brushes.

Use "membrane" technology to clean wash water of soluble solids, this may increase recirculation capability.

4.3.2 Key Opportunities for Reductions of Emissions

The APC sectors have average materials losses of 2-3% which represents \$15-20 million per year.

The EPA Guides to Pollution Prevention - The Paint Manufacturing Industry, EPA/625/7-90/005, listed various waste minimization methods and these have been summarized below in Table 11 together with additional observations. Many of the comments apply also to the Adhesives Industry.

TABLE 11

WASTE MINIMIZATION METHODS

WASTE STREAM	METHODS
Equipment Cleaning (Rinsewater/Solvents & "Sludge")	<ul style="list-style-type: none"> ▶ Use mechanical wipers on mix tanks. ▶ New mixers have automatic wall scrapers. ▶ Use high pressure wash systems. ▶ Use polished steel or teflon lined mix tanks. ▶ Use foam/plastic "pigs" to clean lines * (Note 1). ▶ Reuse equipment cleaning wastes. ▶ Schedule to minimize need for cleaning by colour or product type. ▶ Clean equipment immediately. ▶ Use countercurrent rinse methods where "dirty" liquid is reused in the first rinse. *(Note 2) ▶ Evaluate alternate cleaning agents. ▶ Use de-emulsifiers on spent rinses.
Spills and Off Specification Product	<ul style="list-style-type: none"> ▶ Increase use of automation. ▶ Use correct clean up methods. ▶ Recycle into process. ▶ Review operating practices. ▶ Use Recyclable Containers.
Leftover Pigment Air Emissions	<ul style="list-style-type: none"> ▶ Control bulk storage emissions with conservation vents. ▶ Use floating roofs (used in many industries) for solvent storage. ▶ Improve maintenance checks. ▶ Install dedicated baghouse systems for key pigments for reuse. ▶ Ensure equipment is enclosed and lids used.
Filter Cartridges	<ul style="list-style-type: none"> ▶ Improve pigment dispersion. ▶ Use metal mesh filters that can be reused.
Obsolete Products/Customer Returns	<ul style="list-style-type: none"> ▶ Blend into new products.

* Note 1 and 2 are on page 4-27.

Note 1: *Use of a plastic or foam "pig" to clean pipes.* It was reported that much of the US industry is currently using plastic or foam "pigs" (slugs) to clean paint from pipes. The "pig" is forced through the pipe from the mixing tank to the filling machine hopper. The "pig" pushes ahead paint left clinging to the walls of the pipe. This, in turn, increases yield and reduces the subsequent degree of pipe cleaning required. Inert gas is used to propel the "pig" and minimize drying of paint inside the pipe. The equipment (launcher and catcher) must be carefully designed so as to prevent spills, sprays, and potential injuries, and the piping runs must be free of obstructions so that the "pig" does not become stuck or lost in the system.

Note 2: *A countercurrent rinsing sequence.* For facilities that have additional storage space available, countercurrent rinsing can be employed. This technique uses recycled "dirty" solution to initially clean the tank. Following this step, recycled "clean" solution is used to rinse the "dirty" solution from the tank. Since the level of contamination builds up more slowly in the recycled "clean" solution than with a simple reuse system, solution life is greatly increased. Countercurrent rinsing is more common with clean-in-place systems, but can be used with all systems.

4.3.3 Other Manufacturing Efficiency Opportunities.

A number of companies could use an integrated information management system based on a common data base such as Manufacturing Resource Planning II (MRP II). This type of system integrates all aspects of production such as scheduling, ordering, payments, accounts receivable, sales data, formulations, forecasting, etc. This is important for efficiency improvements in an industry that uses a large number of raw materials and makes a wide range of products. The system imposes many good practices that will yield some efficiencies without computerization.

The use of Statistical Design for new product optimization and process optimization can save time and ensure optimization.

The concept of Continuous Improvement must be extended, from existing practices to an ongoing search for improved equipment to improve productivity. This search should extend to contacts with manufacturers and equipment used in other industries.

The APC industries use Computer Aided Manufacture in a few situations. While it cannot be used in all operations, it can be more widely used by this sector to improve efficiency.

4.3.4 Efficiency Opportunity Audits

To utilize this report in MOEE's "Green Industry" strategy the following pre-audit questionnaire and check list was developed.

4.3.4.1 Pre-audit Questionnaire

The purpose of an audit of a company's energy and water usage and environmental costs is for the identification of the main areas for potential savings.

These items should be given in advance to any company before any proposed visit so that the personnel can be prepared.

1. Energy Audit

The energy consumption should be presented in \$ and \$/kg of product.

Is the energy consumption available for the following areas:

- ▶ "In-house" resin manufacture?
- ▶ Dispersion/Mixing areas?(eg., Primary dispersion units in paint manufacture or hot melt adhesive manufacture.)
- ▶ The warehouse area?
- ▶ The cleaning area? This includes "in-house" solvent recovery.

2. Water Audit

The water consumption should be presented in \$, litres/year and litres/kg of product.

Is the water consumption available for the following areas:

- ▶ "In-house" resin manufacture?

- ▶ Dispersion/Mixing areas? (eg. Primary dispersion in paint manufacture or hot melt adhesive manufacture.)
- ▶ The cleaning area? This includes any "in-house" solvent recovery still.

3. Environmental Losses

There is a need to establish a baseline of information to monitor improvements. This data includes:

- ▶ The sewerage cost in \$.
- ▶ Hazardous materials disposal costs in \$.
- ▶ Non hazardous materials disposal costs in \$.
- ▶ Volatile losses in tonnes/year.
- ▶ Losses of reclaimed solvent in \$.
- ▶ Average losses of product/raw materials as % of total of these items.

4.3.4.2 Check List to Identify Efficiency Opportunities

1. General Area Study for Energy Savings

An IESP study of these industries (Appendix F) identified the following as having good pay back potential for savings. They should be reviewed with the company to see if they can be applied.

	Yes	No
Are low wattage fluorescent tubes in use?	<input type="checkbox"/>	<input type="checkbox"/>
Are there compressed air leaks?	<input type="checkbox"/>	<input type="checkbox"/>
Has air infiltration into the building been examined to reduce heating needs?	<input type="checkbox"/>	<input type="checkbox"/>
Is timed heating, ventilation and air conditioning (HVAC) used to control costs? Have improved HVAC methods been investigated?	<input type="checkbox"/>	<input type="checkbox"/>
Are destratification fans used to reduce heating requirements?	<input type="checkbox"/>	<input type="checkbox"/>
Are the correct fuel/air ratios used to reduce heating costs?	<input type="checkbox"/>	<input type="checkbox"/>
Has steam trap upgrading been considered?	<input type="checkbox"/>	<input type="checkbox"/>
Has heat recovery utilization and combustion heat confinement been investigated?	<input type="checkbox"/>	<input type="checkbox"/>

2 Material Losses

These data are presented in terms of the source of losses and waste management methods. They should be reviewed with companies to see if efficiencies can be achieved.

MATERIALS LOSSES

Waste Stream	Waste Management Methods	Yes	No
		<input type="checkbox"/>	<input type="checkbox"/>
Equipment Cleaning Wastes	Use manual or mechanical scrapers to save product and reduce cleaning.	<input type="checkbox"/>	<input type="checkbox"/>
	Use high pressure wash systems to reduce amounts of cleaning liquids.	<input type="checkbox"/>	<input type="checkbox"/>
	Use polished steel or teflon lining on vessels to reduce product "hang up".	<input type="checkbox"/>	<input type="checkbox"/>
	Use "pigging" of process lines to save product for reuse and to reduce cleaning requirements.	<input type="checkbox"/>	<input type="checkbox"/>
	Reuse equipment cleaning wastes in products.	<input type="checkbox"/>	<input type="checkbox"/>
	Clean equipment as soon as possible to reduce drying to save cleaning requirements.	<input type="checkbox"/>	<input type="checkbox"/>
	Schedule to minimize need for cleaning.	<input type="checkbox"/>	<input type="checkbox"/>
	Use dilute cleaning rinse in first cleaning step to reduce amount used (counter current rinse method).	<input type="checkbox"/>	<input type="checkbox"/>
	Use de-emulsifiers to reduce suspended solids. Monitor other sewer water impurities.	<input type="checkbox"/>	<input type="checkbox"/>
Spills and off specification products	Increase use of automation.	<input type="checkbox"/>	<input type="checkbox"/>
	Improved testing of raw materials and intermediates.	<input type="checkbox"/>	<input type="checkbox"/>
	Recycle back in products.	<input type="checkbox"/>	<input type="checkbox"/>
	Use appropriate clean-up methods.	<input type="checkbox"/>	<input type="checkbox"/>
Leftover pigment in bags/packages	Employee training to empty bags.	<input type="checkbox"/>	<input type="checkbox"/>
	Encourage suppliers to use recyclable dedicated containers.	<input type="checkbox"/>	<input type="checkbox"/>

MATERIALS LOSSES

Waste Stream	Waste Management Methods	Yes	No
		<input type="checkbox"/>	<input type="checkbox"/>
Air Emissions, also Pigment Dusts	Modify bulk storage tanks with conservation vents. Improved leak detection and control. Pumps with back up sealing. Enclose open process vessels. Consider dedicated baghouse systems to be able to recycle key pigments. Improved maintenance.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Filter Bags/Cartridges	Try using metal mesh filters which can be reused. Improved pigment dispersion to reduce solid materials.	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Obsolete Products and Customer Returns	Blend into new products.	<input type="checkbox"/>	<input type="checkbox"/>

3. Process Optimization

Process optimization will result in savings in time and equipment utilization. This can be achieved by techniques like Statistical Process Control (SPC) and Statistical Quality Control (SQC). The following data should be reviewed with companies to see if efficiencies can be achieved.

Equipment/Process	Control Procedures	Yes	No
		<input type="checkbox"/>	<input type="checkbox"/>
Heating/Cooling Resin Equipment Dispersion Equipment Primary Dispersers Hot Melt Mixer Cleaning Equipment Mixing Equipment	Measure water temperature in and out to determine heat transfer efficiency and correct flow rate.	<input type="checkbox"/>	<input type="checkbox"/>
	Are high efficiency motors used to reduce energy costs.	<input type="checkbox"/>	<input type="checkbox"/>
	Are chillers or cooling towers used to reduce water usage.	<input type="checkbox"/>	<input type="checkbox"/>
	The use of SPC techniques requires monitoring:	<input type="checkbox"/>	<input type="checkbox"/>
	<ul style="list-style-type: none"> • Temperatures of product and cooling water. 	<input type="checkbox"/>	<input type="checkbox"/>
	<ul style="list-style-type: none"> • Viscosity of product. 	<input type="checkbox"/>	<input type="checkbox"/>
	<ul style="list-style-type: none"> • Flow rates of water and product. 	<input type="checkbox"/>	<input type="checkbox"/>
	<ul style="list-style-type: none"> • Process time. 	<input type="checkbox"/>	<input type="checkbox"/>
	<ul style="list-style-type: none"> • Power draw. 	<input type="checkbox"/>	<input type="checkbox"/>
	<ul style="list-style-type: none"> • Product quality tests (SQC). 	<input type="checkbox"/>	<input type="checkbox"/>
	The above data and batch to batch variance is used to optimize the process.	<input type="checkbox"/>	<input type="checkbox"/>

4 Systems Improvements

The following systems should be reviewed with companies to determine whether efficiencies can be achieved.

	Yes	No
Computer-Aided Manufacture of Resins, Adhesives and Paints & Coatings.	<input type="checkbox"/>	<input type="checkbox"/>
Improved raw materials and intermediate product testing to speed up final approvals. Supplier involvement in raw material testing should be pursued.	<input type="checkbox"/>	<input type="checkbox"/>
The large number of raw materials and final products used by many manufacturers requires an integrated system, such as MPR II or its equivalent, to efficiently manage all facets of manufacturing. These include inventory control, formulae, scheduling, ordering, accounts receivable, accounts payable, forecasting, etc., from a common database. Small companies who cannot afford to develop/buy a system can still benefit from the discipline of improved control practices to improve some of the problems associated with the these industries.	<input type="checkbox"/>	<input type="checkbox"/>
The allocation of waste management costs to departments that generate them.	<input type="checkbox"/>	<input type="checkbox"/>
The evaluation of high pressure spray cleaning systems. These are claimed to significantly reduce cleanup waste volume. Reference EPA/626/7-90/005.	<input type="checkbox"/>	<input type="checkbox"/>

A 14 page self audit for reductions in environmental releases, prepared by EPA for the Paint Industry in reference EPA/626/7-90/005, has been included in Appendix G.

4.4 New Technologies

4.4.1 Structural Sectoral Issues

The article, "Coatings Research Will Be The Key To Successful Competition", by I.H. McEwan, J. Shapiro and C.H. Kaufmann in COATINGS Magazine, March/April 1993 (Appendix D3) is fully applicable to the Adhesives Sector. Data presented shows that R&D expenditure in the United States, as a percentage of sales, were double that in Canada.

The majority of large and medium sized companies are foreign-owned and rely on their parent companies for formulation and manufacturing technology and are not impacted by the reduced level of Canada R&D for new technologies.

Chemical companies who supply the majority of raw materials, and who were the traditional source of some of the formulating advice to small and medium sized Canadian companies, are reducing that service as a way to reduce operating expenses as they feel the effects of increased competition.

Despite this situation, small US based companies are competing in that market. Please refer to the paper by C.H. Kaufmann, J. Shapiro and I.H. McEwan, "Manufacturing Competitiveness-Is Our Playing Field Level", in COATINGS Magazine January/February 1993 (Appendix D2) which deals with this situation. These comments also apply to the Adhesives Industry.

4.4.2 New Product Development

New product development over the past decade and plans for the future have been driven by environmental concerns. The newer products, as described in industry publications, will continue to be aimed at lower VOC products as well as lower toxicity materials and property enhancements.

The large benefit of VOC reductions is at the end applicator location. This is because over 96% of VOC emissions occur at this location with only minor emission reductions at the APC manufacturing sites.

The future new product development to reduce VOC of APC products will result in no significant efficiencies in energy/water and reductions in environmental emissions at the manufacturing sites. This has been the case with this type of product development in the past.

These new products include:

Waterborne systems with lower VOC than currently being used.

Higher solids systems with lower VOC than currently being used.

The growth of 100% solids systems such as powders or beads will reduce VOC emissions due to the relative ease in trapping particulates versus vapours. The resins will probably be made by specialty manufacturers rather than in-house production by APC companies. These products come in a simple range of colours or clears. There is some on-going R & D on the use of clear coats in automobile finishes.

UV or Radiation Curing ultra high solids systems are projected to have slow growth and no major impact is predicted.

A major effort will be expended to reduce the toxicity of all the components in APC products. Replacements for chlorinated solvents in Adhesives, and isocyanates in both industries are being studied. This will be very beneficial, particularly with Automotive Refinish paints.

Waterborne and high solids technologies have required higher baking temperatures. Work is being directed at lowering the curing temperature at the customer end.

Work is being directed at the use of liquid CO₂ as a solvent to enable the use of low VOC products (mainly coatings) in industrial applications.

4.4.3 Developments in Process and Manufacturing Technology

The following Table 12 lists some of the technology developments and operating practices that are either impacting now or are expected to impact the APC industries in the next 5-10 years. The technologies are grouped as follows: waste reduction, testing equipment, computer aided systems, and manufacturing equipment improvements.

TABLE 12

EFFICIENCY IMPROVEMENTS IN MANUFACTURING TECHNOLOGY

TOPIC	AREA OF APPLICATION/TECHNOLOGY
Waste Reduction	<ul style="list-style-type: none"> ▶ Improved high pressure jet design to reduce cleaning liquid volumes. ▶ The replacement of bags with returnable lined containers. ▶ Removal of suspended and soluble solids in waste cleaning water.
Testing Equipment	<ul style="list-style-type: none"> ▶ Automated in line testing designed for APC products. Viscosity, flow rate, IR spectra, refractive index, etc. use of fibre optic technology for sensors, etc.
Computer Systems	<ul style="list-style-type: none"> ▶ Linkage of MRP II type systems to sales at the store register to improve inventory control/scheduling. ▶ Improved Computer Aided Manufacture and the move to Distributed Control Systems.
Manufacturing Equipment Improvements	<ul style="list-style-type: none"> ▶ Reduced hang up in primary dispersion equipment; e.g., by the use of centrifugal force. ▶ Improved mechanized scraping in tanks and portable containers. ▶ Improved filtering systems designed for APC products.

While most of the technologies and operating practices have been discussed earlier, a few comments are given here about wastewater treatment technologies.

The amount of process wastewater generated and discharged at APC plants can be reduced by 80 to 90% by the use of high pressure spray heads and limiting wash/rinse time and recycling/reuse of process wastewaters. Furthermore, the sludge or highly concentrated spent waste streams can also be treated by one or a combination of the following waste treatment technologies. This would further reduce the amount of wastes to be drummed for off-site.

Alternative waste treatment technologies that are currently available but not used by the APC industries, could offer potential technical and economic advantages. These systems can be membrane based, variations of conventional ion exchange, or combinations of systems. A brief description of the available technologies and their viability is given in Appendix E.

4.5 Application to Other Industries

The APC Industries belong to the Chemical sub-group of Formulated Products and Specialty Chemicals. This sub-sector includes paints, soap and cleaning compounds, toiletry preparations, printing inks, adhesives, industrial processing aids, specialty chemicals and fine chemicals.

The APC manufacturers are characterized by using batch processes involving large numbers of raw materials to make a large number of products. The formulations involve mixing viscous liquids. Cleaning of equipment is a major activity.

There are some similarities in operations within the Chemical industry and the sub-group including the APC industry. As a consequence, some of the findings in this study may apply to other formulated product industries.

The concept of environmental stewardship in the paint industry appears to be on the verge of a pilot launch to use excess customer house paint to make new products. This example could serve as a model to other manufacturers as to what can be achieved in an apparently difficult area.

The Canadian Paint and Coatings Association's role in the communication of environmental regulations, via various publications, is a model that could be expanded to their sector associations.

The weakness in Canadian research and development within many sectors of the Chemical Industry could be partially overcome by cooperative work by an independent body. Difficulties in achieving this have arisen in the past. However, encouragement to industry associations to fill this type of role is recommended.

The raw materials suppliers to these industries do valuable research and development. This source of support may be of interest to the multi-Ministry Green Industry Strategy. Examples would be to promote "easy to disperse pigments and fillers" to reduce energy usage or to develop reusable lined containers to replace paper bags as another way to reduce solid waste.

In the area of Human Resources, the Paint Industry in Toronto area has fostered and staffed courses on paint

technology at George Brown College. These courses could be part of Ontario's apprenticeship program that covers general industry training. This approach could be encouraged in other industries.

The practices in the Food Processing Industry could be studied to benefit the APC Industries. The food industry makes many small batches rapidly and has fast filling that could benefit smaller APC manufacturers. They also have highly effective cleaning methods for their batch equipment.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The APC industries are an important part of Ontario's industrial sector with 1991 sales of over \$ 1 billion and employing about 6400 people. These industries purchased about \$500 million of materials to further supplement Ontario's economy.

The effects of competition resulting from FTA and NAFTA have been felt by the APC industries and although various efficiency improvements are being implemented, this report presents a further opportunity to these industries for additional savings.

This study has identified the main areas for efficiency savings in the process area to be cleaning and environmental releases.

Because savings in energy and water and reductions in environmental releases are relatively modest, it is recommended that these savings be combined with savings in materials to present an attractive goal to the APC Industries.

It is anticipated that significant benefits will result from a series of small gains resulting from a large number of actions.

It is recommended that MOEE should proceed with its plans for Green Industry analysis of the APC sectors to identify and implement reductions in energy and water use and reductions of environmental releases.

A goal of 10-15% savings of total energy costs from the process area should be set.

A goal of water savings and a reduction of environmental releases should be tied to a reduction of raw materials and product losses. The savings in material losses are estimated at \$ 15-20 million per year. Although it was not possible to quantify accurately water savings, reductions of the order of 30% should be achievable.

MOEE should communicate the Green Industry Program to the APC sectors through industry associations, trade journals and magazines and by presentations at industry seminars.

APPENDIX A

TERMS OF REFERENCE

FOR A SECTOR STUDY ON ADHESIVES AND PAINTS & COATINGS INDUSTRIES

TERMS OF REFERENCE

FOR A SECTOR STUDY ON ADHESIVES AND PAINT & VARNISH INDUSTRIES

I. OBJECTIVES:

The purpose of this assignment is to provide the Industry Programs Branch (IPB) of the Ministry of Environment and Energy (MOEE) with a clear, concise document outlining 5 main topics as explained in III. Scope, on the Adhesives and Paint & Varnish Industries of the Chemical and Chemical Products Industries Sector, based in Ontario.

This document will form the basis for an advocacy/advisory package offered to industry associations, member companies and other Government agencies related to the Chemical Sector with the intention that this Industrial Sector will adopt the main principles of energy/water efficiency and reduction of environmental releases. The adoption of such principles and practices will assist industrial operations to reduce operation costs, thus become more competitive in the global marketplace. It will also serve some of the primary objectives of the MOEE which are to foster a growing economy, energy and water conservation and a cleaner environment in Ontario.

II. BACKGROUND:

The Industry Programs Branch has traditionally been the lead Government agency in advocating, fostering and catalyzing energy efficiency and conservation amongst the industrial sectors in Ontario. In addition, jointly with the Green Industry Office of the MOEE, the Branch is spearheading the Green Industry Strategy.

Through a spectrum of programs and activities comprising expert advice, education and financial assistance, the Branch has acquired a sound market intelligence on energy, and to a lesser extent, water usage in the industrial base of the Province. Recently the Branch completed a pilot Green Analysis project which contributed information on potential to reduce environmental releases in some sectors.

Analysis of the Branch's existing information has led to the decision to assess the feasibility of focusing on some of the industrial sectors which are significant to the economy of the Province, show good promises of energy/water efficiency and environmental releases reduction, and are amenable to improvements by existing and up and coming technologies. For these reasons the Adhesives and Paint & Varnish Industries of the Chemical Sector have been selected as suitable candidates for a sector-specific study. The choice of this sector is supported by the Ministry of Economic Development and Trade's Sector Partnership strategy.

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III. SCOPE:

The consultants will report to:

Soussan Tabari
Program Coordinator
Industry Programs
Ministry of Environment and Energy
56 Wellesley St. W
14th Floor
Toronto Ontario
M7A 2B7

Tel: (416) 327 1440
Fax: (416) 327 1261

They will work with the staff of the MOEE and, if applicable, other line ministries designated by her. The project is under the direction of Linda Ploeger, General Manager of the Industry Programs Branch.

The consultants will provide the MOEE with a final report in which they will discuss in depth the following topics:

1. Sector Profile:

a) a detailed, thorough description of the current profile of the Adhesives and Paint & Varnish Industries, including its economic status, its energy, water and resource usage, its cost of energy/water per unit of production, its infrastructure needs and usages, and its environmental pressure points.

b) a detailed projection of the sector's future environmental, energy, water and resources usage and related anticipated trends.

2. Generic scope of work:

a) a description of the main types of processes involved in Adhesives and Paint & Varnish plants.

b) a comprehensive description of all areas of process and equipment in each type of Adhesives and Paint & Varnish plants that should be examined in order to identify the optimum number of opportunities for conservation and efficient use of energy and water, and source reduction of environmental releases.

It is emphasised that MOEE is primarily interested in a scope of work for areas that show potential for economically viable improvements (normally a simple payback period of up to 5 years). If there are areas of a plant that warrant evaluation but are not amenable to economic implementation, it is expected that the consultants will exercise judgment based on their own experience and will discuss these types of potentials separately.

3. Key efficiency opportunities: a brief description of commercially available equipment, technologies and management systems and practices that can be readily and economically accessed by any of the member companies of the Adhesives and Paint & Varnish Industries. The listing should comprise all means leading to savings and improvements that can be achieved immediately or in a short period of time (up to 5 years).

4. New technologies: a brief description of energy and water efficiency, and environmental releases reduction technologies that are being researched and developed and will be applicable to the Adhesives and Paint & Varnish Industries in the next 5 to 10 years.

5. Applicability to other industries: a brief discussion on the replicability of items 2, 3 and 4 to other industrial sectors.

IV. METHODOLOGY:

The consultants will state the approach they intend to take to complete each of the five main tasks as outlined in III. Scope.

Based on the consultants' previous experience and up-to-date knowledge of the Adhesives and Paint & Varnish Industries, the IPB expects them to propose their approach to conduct this project. Thus other than the following requirements, the IPB is not dictating the methodology:

1. Reference material: in order to accomplish task 1. Sector Profile it is required that in addition to other literature, the following two reference sources will be consulted:

a) publications by Industry Canada (previously the Department of Industry, Trade and Technology) called "Industry Profile" and,

b) publications or information provided by the Sector Development Division, Ontario Ministry of Economic Development and Trade

2. Baseline data: to assist with task 3. **Key Efficiency Opportunities** MOEE will furnish the consultants with baseline data from the Industrial Energy Services Program (IESP) and, if consented by client companies, results of the pilot Green Analyses. Information such as annual energy consumption, potential savings, types of energy efficiency opportunities, simple payback periods, etc. which have been collected and compiled in the course of energy/water analyses conducted under the IESP will form the point of departure for additional information that will be contributed by the consultants.

3. Consultation with stakeholders: At the onset and throughout the project, the consultants are requested to work in consultation with, but not restricted to, the **Ministerial Advisory Committee on Chemicals**, struck by the Ministry of Economic Development and Trade.

4. Timing: The project can not afford a preliminary phase of grass root research/compilation and the expectations of the IPB are that the consultants will readily draw on their own existing knowledge and experience, and the collective intelligence and infrastructure of their affiliated Consulting Firm. This specifically applies to task 1. Industry Profile, for which readily available literature compilations can be utilised. The consultants are required to specify the timing they intend to allocate to each task. The entire project is to be completed on or before **March 31, 1994**.

V. SELECTION CRITERIA

a) Mandatory

1. Contractual agreement

The consultants must be willing to sign a contractual agreement similar to the enclosed blank copy.

2. Previous experience and performance on similar assignments

The consulting firms must clearly demonstrate their past experience and performance on similar assignments, and provide a list of previous clients that MOEE can use as reference. Furthermore, the MOEE reserves the right to consult the internal performance evaluations that it conducts on the consulting firms who are members of the IESP Roster and have performed IESP analyses.

3. Demonstrated knowledge of the Adhesive and Paint & varnish Industries

The consultants assigned to the project must have first hand knowledge and at least 10 years or equivalent experience in operational engineering, energy efficiency, water usage and source reduction of environmental releases in the Chemical and Chemical Products industries. Thus, although the contract will be awarded to a Consulting Firm, it is the expertise and qualifications of the individual consultants assigned to the project that will be a significant deciding factor in which firm shall receive the contract.

4. Timing

The project must be completed on March 31, 1994. But without compromising the quality of the final report, it is desirable to receive the report prior to that date.

b) Desirable

1. Resources assigned to the project

The number of consultants assigned to the project, their qualifications, and number of years of experience in the Adhesive and Paint & Varnish Industries.

2. Quality of the proposal

Clear understanding of the project, thoroughness, relevance, issues raised but not mentioned in the Terms of Reference especially on Methodology, and completeness of the submitted package.

3. Cost of the project

APPENDIX B

RANKING OF THE CHEMICAL AND FORMULATED

PRODUCTS AND SPECIALTY CHEMICALS INDUSTRIES

APPENDIX B
RANKING OF THE CHEMICALS AND FORMULATED
PRODUCTS & SPECIALTY CHEMICALS INDUSTRIES

1. The ranking of the Canadian Industry Sectors in 1991 are as follows (Source: Statistics Canada):

Industry Sector	1991 Value of Manufacturing Shipments (\$ Billions)	Ranking
Transport	48.	1
Food	38.	2
Chemicals	21.3	3
Paper	21.	4
Electrical	19.5	5
Petroleum	18	6
Primary Metals	17.5	7
Fabricated Metals	16.	8
Wood	13.5	9
Printing	13.	10

The APC subsector represents 8% of the value of shipments of the Chemical Sector.

APPENDIX B
RANKING OF THE CHEMICALS AND FORMULATED
PRODUCTS & SPECIALTY CHEMICALS INDUSTRIES

2. Within the formulated Products and Specialty Chemicals subsector in 1991 the rankings are as shown below for Ontario (Source: Statistics Canada):

Formulated Products and Specialty Chemicals	Establishments	Shipments (\$ Million)	Employment	Ranking (Shipments)
Specialty & Fine Chemicals	43	780	3,120	4
Paint & Coatings	67	860	4,600	3
Chemical Specialties	151	2,580	13,790	1
Other Specialty Chemical Products	106	1,010	7,340	2
TOTAL:	367	5,230	28,850	-

APPENDIX C

C1: NAMES OF MAJOR ADHESIVES MANUFACTURERS

C2: NAMES OF MAJOR PAINTS AND COATINGS MANUFACTURERS

APPENDIX C1

NAMES OF MAJOR ADHESIVES MANUFACTURERS

(EXCERPT FROM INDUSTRY PROFILE ADHESIVES AND SEALANTS

DEPARTMENT OF INDUSTRY, TRADE AND TECHNOLOGY)

MAJOR FIRMS

Name	Country of ownership	Location of major plants
CSL Silicones Inc.	Canada	Guelph, Ontario
Canadian Adhesives Limited	Germany	Montreal, Quebec Brampton, Ontario
Chembond Limited	Canada	Mississauga, Ontario
Dow Corning Canada Inc.	United States	Mississauga, Ontario
H B. Fuller Canada Inc.	United States	Boucherville, Quebec Mississauga, Ontario
GE Silicones Canada Ltd	United States	Port Union, Ontario
Halitech Inc.	Canada	West Hill, Ontario
Helmutin Canada Inc.	Canada	Montreal, Quebec Etobicoke, Ontario
Lepage's Limited	United Kingdom	Brampton, Ontario
Mapei Canada Inc.	Italy	Laval, Quebec
Mulco Inc	Canada	Saint-Hubert, Quebec
Nacan Products Limited	United Kingdom	Boucherville, Quebec Toronto, Ontario Surrey, British Columbia
PRC Canada Inc	United Kingdom	Rexdale, Ontario
Pierce & Stevens Canada Inc	United States	Fort Erie, Ontario
Roberts Company Canada Limited	United States	Bramalea, Ontario
Swift Adhesives Ltd	Japan	Moncton, New Brunswick Pointe-Claire, Quebec Bramalea, Ontario Winnipeg, Manitoba Burnaby, British Columbia
Timmenco Industrial Adhesives	Canada	Pointe-Claire, Quebec North York, Ontario
Tremco Ltd.	United States	Toronto, Ontario

INDUSTRY ASSOCIATION

Adhesives and Sealants Manufacturers
Association of Canada
Suite 1400, 1 Yonge Street
TORONTO, Ontario
M5E 1J9
Tel.: (416) 363-7261
Fax: (416) 363-3779

Table 1: Summary of Data	
Category	Value
Category A	10
Category B	20
Category C	30
Category D	40
Category E	50
Category F	60
Category G	70
Category H	80
Category I	90
Category J	100

APPENDIX C2

NAMES OF MAJOR PAINTS AND COATINGS MANUFACTURERS

(EXCERPT FOR INDUSTRY PROFILE PAINTS AND COATINGS

DEPARTMENT OF INDUSTRY, TRADE AND TECHNOLOGY)





COATING FIRMS

Name	Country of ownership	Location of major plants
BASF Canada Inc.	Germany	Brantford, Ontario Windsor, Ontario
Benjamin Moore & Co. Ltd.	United States	Toronto, Ontario Burlington, Ontario Montreal, Quebec Vancouver, British Columbia
Cloverdale Paint Inc.	Canada	Surrey, British Columbia Edmonton, Alberta
Color Your World Corp.	Canada	Toronto, Ontario Vancouver, British Columbia
Du Pont Canada Inc.	United States	Ajax, Ontario
General Paint Ltd.	United Kingdom	Vancouver, British Columbia
ICI Paints (Canada) Inc.	United Kingdom	Concord, Ontario Boucherville, Quebec
International Paints (Canada) Limited	United Kingdom	Baie-d'Urfé, Quebec Regina, Saskatchewan
PPG Canada Inc.	United States	Mississauga, Ontario
Para Inc.	Canada	Brampton, Ontario
Pratt & Lambert	United States	Fort Erie, Ontario
Prilco Inc. ^a	Canada	Etobicoke, Ontario
Selectone Paints Limited	Canada	Weston, Ontario
Sico Inc.	Canada	Beauport, Quebec Longueuil, Quebec Outremont, Quebec Rexdale, Ontario St. Catharines, Ontario
Valspar Inc.	United States	West Hill, Ontario

^aPrilco Inc. is the architectural coatings segment of the former DeSoto Coatings Ltd., acquired by Sico Inc. in 1991. Previously, the aerospace coatings segment of DeSoto had been sold to PRC Canada Inc., and the industrial coatings segment had been sold to Valspar Inc.

No. of persons			No. of persons		
Male	Female	Total	Male	Female	Total
1	1	2	1	1	2
2	2	4	2	2	4
3	3	6	3	3	6
4	4	8	4	4	8
5	5	10	5	5	10
6	6	12	6	6	12
7	7	14	7	7	14
8	8	16	8	8	16
9	9	18	9	9	18
10	10	20	10	10	20
11	11	22	11	11	22
12	12	24	12	12	24
13	13	26	13	13	26
14	14	28	14	14	28
15	15	30	15	15	30
16	16	32	16	16	32
17	17	34	17	17	34
18	18	36	18	18	36
19	19	38	19	19	38
20	20	40	20	20	40
21	21	42	21	21	42
22	22	44	22	22	44
23	23	46	23	23	46
24	24	48	24	24	48
25	25	50	25	25	50
26	26	52	26	26	52
27	27	54	27	27	54
28	28	56	28	28	56
29	29	58	29	29	58
30	30	60	30	30	60
31	31	62	31	31	62
32	32	64	32	32	64
33	33	66	33	33	66
34	34	68	34	34	68
35	35	70	35	35	70
36	36	72	36	36	72
37	37	74	37	37	74
38	38	76	38	38	76
39	39	78	39	39	78
40	40	80	40	40	80
41	41	82	41	41	82
42	42	84	42	42	84
43	43	86	43	43	86
44	44	88	44	44	88
45	45	90	45	45	90
46	46	92	46	46	92
47	47	94	47	47	94
48	48	96	48	48	96
49	49	98	49	49	98
50	50	100	50	50	100
51	51	102	51	51	102
52	52	104	52	52	104
53	53	106	53	53	106
54	54	108	54	54	108
55	55	110	55	55	110
56	56	112	56	56	112
57	57	114	57	57	114
58	58	116	58	58	116
59	59	118	59	59	118
60	60	120	60	60	120
61	61	122	61	61	122
62	62	124	62	62	124
63	63	126	63	63	126
64	64	128	64	64	128
65	65	130	65	65	130
66	66	132	66	66	132
67	67	134	67	67	134
68	68	136	68	68	136
69	69	138	69	69	138
70	70	140	70	70	140
71	71	142	71	71	142
72	72	144	72	72	144
73	73	146	73	73	146
74	74	148	74	74	148
75	75	150	75	75	150
76	76	152	76	76	152
77	77	154	77	77	154
78	78	156	78	78	156
79	79	158	79	79	158
80	80	160	80	80	160
81	81	162	81	81	162
82	82	164	82	82	164
83	83	166	83	83	166
84	84	168	84	84	168
85	85	170	85	85	170
86	86	172	86	86	172
87	87	174	87	87	174
88	88	176	88	88	176
89	89	178	89	89	178
90	90	180	90	90	180
91	91	182	91	91	182
92	92	184	92	92	184
93	93	186	93	93	186
94	94	188	94	94	188
95	95	190	95	95	190
96	96	192	96	96	192
97	97	194	97	97	194
98	98	196	98	98	196
99	99	198	99	99	198
100	100	200	100	100	200

APPENDIX D1

REPRINT FROM COATINGS MAGAZINE

“EXPLORING THE COMPETITIVENESS OF CANADA’S PAINT INDUSTRY”

AUTHORED BY:

DR. JACOB SHAPIRO

MR. C.H. KAUFMANN

DR. I.H. MCEWAN



Competitiveness

Exploring the competitiveness of Canada's paint industry

by J. Shapiro, C.H. Kaufmann, and
L.H. McEwan

As the debate about merits of the Free Trade Agreement (FTA) continues and the debate about the North American Free Trade Agreement (NAFTA) is just getting underway, it is worth considering the implications of these agreements for the competitiveness of the Canadian paint industry.

That is, it is worth thinking about what changes should the industry expect to see in future as a result of FTA and NAFTA, and what should it be doing about these changes? There should be little doubt that there are important changes happening in the industry. Consider the following industry developments that were covered by the trade press in the past two years:

1989: PPG shuts down Toronto Lakeshore paint plant; transfers production to USA;

1991: Ferro shuts down Toronto powder coatings plant; transfers production to USA;

1991: ICI shuts down plants at Bramalea, Montreal and Toronto, consolidates at Boucherville and Concord;

1991: Ford announces \$430 million paint line in Oakville, Ont., aimed at North American market;

1991: Benjamin Moore opens a new \$30 million resin plant in Burlington, Ont.;

1991: BASF opens a \$30 million water-borne plant in Windsor, Ont., aimed at North American market;

1991: PPG announces a \$25 million water-borne plant in Clarkson, Ont., aimed at North American market;

1991: Akzo shuts down its Rexdale, Ont., plant, transfers production to U.S. facilities;

1992: Sico sells Sterling powder business to DuraCoat; DuraCoat consolidates production at Grimsby plant.

In this first article of a series on the factors that affect the competitiveness of Canada's paint industry, our three consultants, each with a long history in the paint business, examine the events of the recent past and place them in context with the present...and the future.

These are the responses of Canadian paint companies to the changing economic times and market circumstances. Each is an example of a business decision about a Canadian paint operation, be it investment or a plant closure, that was made in the context of a North American market.

The plant closures are, basically, business decisions by large multi-plant

organizations to shift their manufacturing operations to more modern and lower cost facilities, often in the United States. Thus, while Canadian paint customers will likely continue to purchase paint from the same suppliers, the paint will, in future, be manufactured in the States.

The investment decisions reflect in each case intentions to serve the North American market from a Canadian base because it makes good business sense to do so. It's clear that Canadian paint manufacturers have recognized that they have to compete on cost and quality on an increasing number of products in both U.S. and Canadian markets and are taking steps to ensure that they can do that successfully.

This is the first of a series of papers that are intended to provide an insight into the competitive issues facing the paint industry and offer suggestions for dealing with these issues so as to win the serious competitive game that Canadian paint companies are playing with the U.S. and Mexican paint companies. This paper will provide a general over-

Jacob Shapiro

Dr. Jacob Shapiro was educated at McGill University and the University of Cambridge. He worked for 20 years with a number of different businesses in ICI Canada in marketing, business development and R&D. Prior to leaving ICI in 1991, he was general manager of automotive paints business. In 1991, he established Dr. J. Shapiro & Associates, specializing in industrial marketing, management of technology and business development aimed at chemicals, plastics and paints industries. He lives in Toronto.

Charles Kaufmann

Charles Kaufmann was educated at the University of Manitoba. His 38 year career with ICI included technical and commercial responsibilities for automotive paints, wood finishes and appliance finishes. Prior to his retirement in 1990, Mr. Kaufmann was business manager of automotive paints. Since then, he has been consulting in product development, technical evaluation and technical service assistance. He lives in Toronto.

Ian McEwan

Dr. Ian McEwan was educated at the University of Wales. His 33 year career with ICI included progressively senior levels of research management in the paints business. Prior to his retirement in 1991, he was research manager. Since his retirement, Dr. McEwan has been consulting actively in Canada and internationally. He is an active member of the Chemical Institute of Canada and Toronto Society for Coatings Technology. He lives in Schomberg, Ont.

view of the competitive issues facing the industry. Future papers will discuss technology, manufacturing costs and marketing in more detail.

Industry structure

Canadian paint manufacturers are quite concentrated in two ways.

First, of the total of about 120 companies that are engaged in paint manufacture in Canada, the top 50 account for about 90 per cent of domestic paint production. This means that about 70 companies are quite small, averaging \$2-3 million in annual sales.

Second, about two thirds of the larger

firms are foreign controlled. Most of the smaller firms are Canadian controlled. The shipments by all Canadian paint companies in 1990 were a substantial \$1.6 billion, of which a meager \$58 million were exported. About \$290 million of paint was imported into Canada in 1990. This represents 16 per cent of the total domestic paint market with most of the imports coming from the USA.

While the import activity could be seen as a threat, it should also be seen as an opportunity for Canadian based manufacturers to displace some of these imports with domestic production. The

opportunity is substantial; if Canadian producers displaced all imports, their production would increase almost 20 per cent! However, a much bigger opportunity is to participate in the huge U.S. market. The U.S. market is about nine times the size of Canadian market. The 1990 exports of \$58 million, which went mostly to the U.S., represent a mere 0.3 per cent of the U.S. market. Put another way, 1 per cent of the U.S. market represents about \$150 million in annual sales and is bigger than most of the larger Canadian paint companies!

Probably, the single biggest driving force that has had an influence on the industry in the past ten years is environmental legislation. For example, environmental legislation on Volatile Organic Compounds (VOC) has resulted in the introduction of new resins, new additives, and totally new paint formulations. Environmental legislation has changed dramatically how paint plants operate and how they dispose of solid and liquid waste. Even consumer products have been reformulated to be "more environmentally friendly," e.g. Environmental Choice Program.

Because of its much greater size, the U.S. market is the base for most of the multinational companies that operate in Canada. The size of the U.S. market provides these companies with a substantial revenue base to support product and process R&D, which is an important component of the paint and coatings industry. A future paper will deal with the subject of technology in more detail.

The Canadian market for paint and coatings, like many other markets, has become part of a global market. The major producers of paint in Canada are subsidiaries of multi-national companies, i.e. BASF, Benjamin Moore, DuPont, ICI, PPG, etc., employing technology developed in other countries. Many of the suppliers to industry are multi-national companies, e.g. Dow, Rohm & Haas, Kronos, etc. Many customers are multi-national companies, e.g. GM, Ford, Honda, or domestic manufacturing companies with export markets, e.g. Bombardier, Magna International.

FTA and NAFTA have sensitized U.S. and Mexico-based paint producers that the Canadian paint market is accessible and represents a significant 10 per cent of the U.S. market. This greater awareness is a double edged sword. On the one hand, realization by U.S. companies that Canadian manufacturing

facilities can produce high quality, sophisticated coatings at competitive costs resulted in investments in Canadian plants by BASF and PPG. On the other hand, realization that Canadian market is close and, with lower tariffs, can be easily served from U.S. sites, resulted plant closures by Akzo, Ferro, and PPG.

It's clear, therefore, that managers of both foreign owned and Canadian owned paint operations should be asking themselves: "What can they do to ensure the survival of their operations and to take advantage of their existing strengths and skills in marketing, technology, distribution, etc. to expand their sales by displacing imports to Canada and/or by developing new export markets in the U.S. and Mexico?"

Customers' expectations

There is now a much higher standard in terms of quality, on-time delivery, and service than existed five or ten years ago. While the higher standards are most apparent in the automotive industry, they exist in all segments of the paints industry. This is not to imply that the quality standards in the industry prior to 1980 were poor. All paint companies operated at roughly the same level of quality, delivery and service standards. However, in 1980's the automotive producers began to demand a significantly higher level of performance from their suppliers.

The automotive industry was fighting for its survival and concluded that to survive it had to set the same standards for its suppliers as the Japanese automotive industry had set for its suppliers in Japan and around the world. The practice of 'Quality Audits' and 'Quality Awards' was thus introduced. The result was that much stricter specifications were set for coatings products that were supplied by the paint companies. But that was not all. The automotive producers demanded and got reduced inventories of finished products at their manufacturing locations combined with promises of JIT (Just In Time) deliveries and levels of service that were unimagined before. Paint companies were asked, and agreed, to appoint teams of technical service representatives to work full time at the automotive assembly plants. The paint companies were asked to take over the automobile producers' responsibilities for approval of quality of both delivered paint and paint applied on cars.

This example taken from the automotive industry has repeated itself throughout other industry segments that

purchase paint and coatings, with different variations.

It goes without saying that the higher standards for quality and for service, initially, come at a cost. The paint suppliers were asked to pay for all additional costs out of their operations. The argument applied correctly by the automotive companies was that if the paint suppliers employed practices of Total Quality Management, the higher quality standards, JIT delivery, and higher service need not cost more money.

In fact, the overall operating costs

Quality Improvement and cost savings are part of the continuous improvement process that never ends, and should include suppliers to the paint industry to help meet customer expectation.

should be lower if TQM is applied properly. TQM is a philosophy that enables management to run the business at the lowest cost and highest quality and service. In addition, JIT can become the basis of a considerable regional or local strength that suppliers should exploit.

The lesson here is not that the automotive industry was hard nosed and not very understanding of the problems that its coatings suppliers were facing. The lesson is that in a short period of about 10 years, the standards for doing business with automotive and other paint customers have changed more than they changed in the previous 100 years. These standards are now the norm across many other industries and represent the accepted way of doing business.

In addition, an important component of TQM philosophy is that quality improvements and cost savings are part of a "continuous improvement process" that never ends and should include the suppliers to the paint industry. For an industry where raw material and packaging costs represent more than half of the sales dollar, it's vital that suppliers help to solve some of the quality and cost expectations that customers have set. An interesting example of that is the development a few years ago in the paint can industry. Canadian paint companies decided to change from metric cans to U.S. gallon cans to give them the option of buying cans from U.S. companies, which, in some cases,

offered cans at a lower price than Canadian companies.

Industry cost structure

Probably, the biggest single impact of the FTA on the Canadian paint industry was to sensitize the multi-national paint companies that Canada exists and that it can be served easily from almost any location in North America. The era where Canadian branch plant operations were needed to deal with the prohibitively high import duty was officially over.

The immediate effect was that Canadian paint production that was under control of multi-national companies came under scrutiny to see whether it made sense to continue to manufacture in Canada. In the case of old plants that could not compete with the low cost operation of large and more modern U.S. facilities, their fate was sealed as soon as the current recession arrived. The recession exposed the weaknesses of the older operations and with reduced production requirements, made them redundant.

Conversely, managers of Canadian operations of multi-national paint companies could see that their operations could form the base for growth to supply the North American market for automotive and other industrial paint finishes. BASF's and PPG's decisions to invest in Canada in expanded manufacturing facilities to manufacture water-borne automotive coatings were based on the conviction that Canadian facilities were cost competitive and had the skills to manufacture these high quality specialized products.

Earlier, a reference was made to the fact that raw materials and packaging costs represent over half of paint and coatings manufacturers sales revenues. This is by far the single biggest cost component in the industry. Suppliers of raw materials and packaging to the Canadian industry must not only understand this, but must also become active partners in the paint industry's operations. The suppliers must understand that their customers are competing daily with U.S. paint companies and if the U.S. companies have lower raw material and packaging costs, the Canadian paint producer is not going to be around very long. Something is going to give.

While cost of labor is a smaller cost component than raw material and packaging, it is significant and represents generally 10-15 per cent of sales. With the Canadian dollar at about US\$0.80-0.85, Canadian labor costs are

competitive with U.S. labor costs. It's important to realize, however, that flexibility of labor force is an important issue and that lack of flexibility tips the scales in favor of locating manufacturing facilities in the United States.

U.S. paint producers operate generally plants based on bigger batches and, therefore, realize considerable economies of scale. For example, while Canadian manufacturers of trade paint produce economically competitive batches of white paint, the manufacture of colored paint is generally done in smaller batches. This leads to inefficiencies and added costs.

One way forward for Canadian trade paint producers could be to form alliances with medium sized U.S. companies. One possible type of alliance would have the Canadian company look after all marketing in Canada and produce certain paint lines for sale on both sides of the border. In turn, the U.S. ally would be responsible for marketing there and produce certain paint lines for both U.S. and Canadian markets. This would make good use of both companies' distribution and manufacturing strengths. A more aggressive approach would be to export to the U.S. market and develop a bigger customer base so that the manufacturing operations could be expanded to a competitive size.

Trade paint market

The paint market comprises two quite different market segments: trade paint and industrial paint. In Canada, these two markets are about equal in size, each about \$0.9 billion per year at the manufacturers level. However, average prices of industrial coatings are about 50 per cent higher than the average prices of trade paint.

Trade paint market, with over 80 per cent of sales generated by the DIY market and professional painters, requires good distribution and brand image in addition to good product quality and service to succeed. Trade paint is a regional manufacturing business. Put another way, Canadian trade paint manufacturers compete largely with other regional manufacturers. Thus, an Ontario trade paint producer would compete with other Ontario producers as well as with producers located in Quebec and in states situated near the Canadian border.

An important regional difference are the buying habits of professional painters. They vary substantially from province to province. For example, professional painters in B.C. prefer to

Cross border shopping was a profound development that forced retailers to review their pricing and cost structures so they might remain competitive.

use airless spray guns for painting, while in Ontario the preference is for heavy rollers. The formulation of paint must be adjusted to allow for these different application preferences. This is clearly a strength that Canadian paint producers have and must continue to exploit as they compete with U.S. producers who are knocking loudly on the doors of Canadian consumers.

For example, cross-border shopping has become recently an issue because the price differences for the same products on either side of the Canada-U.S. border became too great. The consumers forced producers to rethink their pricing policies after the Canadian retailers and manufacturers started to lose significant revenues to U.S. businesses.

This was a profound development.

Suddenly, Canadian businesses that enjoyed the loyalty of Canadians found out that FTA was not just for the automotive manufacturers but for everybody, including paint retailers. In effect, what happened almost overnight was that Canadian paint retailers and manufacturers had to review their pricing and cost structure to decide how to respond to this development. While the jury is still out on this one, one thing is clear. Canadian paint manufacturers and retailers must be competitive with U.S. manufacturers and retailers. And, while initially this may cause some pain, the adjustment by Canadian manufacturers to a more competitive market will enable them to succeed in developing export business in the U.S. market.

The biggest Canadian owned paint company is Sico Inc. Based in Longueuil, Que., Sico is a publicly traded company with 1991 sales of \$157 million. The majority of Sico's business is in trade sales, with a very strong share of the Quebec trade paint market. Just over one-quarter of the business is in industrial coatings, adhesives and sealants. With the exception of 1991, Sico generated, historically, good profits. In 1980's, Sico invested in both

consumer and industrial paint operations in the United States. These investments proved disappointing and Sico divested itself in 1991 of most of its U.S. activities. This is disappointing because, in theory, Sico had the best chance of succeeding in the U.S. market because of its considerable financial resources. On the positive side, Sico is sufficiently large that it can continue to compete successfully in Canadian markets. Perhaps, the lesson to be learned from Sico's experience is that trade paint business is a regional business based on brand recognition

and distribution strengths. Sico could not, apparently, realize any significant synergy between its considerable strengths in the Quebec trade paint market and its U.S. activities.

Industrial paint market

The industrial paint business is carried on mainly through direct sales to industrial customers. The business is driven largely by product performance, which in turn depends on product formulation, and on service. This is clearly not a regional business. Multi-national companies are very active in large market segments such as automotive

and can coatings. This market offers significant opportunities to export because price is higher, distribution is simpler and products based on new or unique technology can be exported.

This is an ideal export market for both large companies and good niche players. We discussed earlier Canadian investments by BASF and PPG aimed at North American automotive coatings market. This market segment requires resources of a large multi-national company. However, there are examples of smaller Canadian companies who successfully exploit niche export markets.

An interesting example is Guertin Bros. Coatings & Sealants Inc. based in Winnipeg, Man. This is a medium sized company that manufactures and distributes industrial coatings and compounds. The company has developed and patented a novel resin that can be used to formulate a variety of high solids, low VOC, two component, isocyanate-free urethane coatings, including finishes for the transportation market. The company is now actively licensing its proprietary resin technology in Europe and the United States. This is an excellent example of a Canadian invention being commercialized in the export markets.

Another example is Adamin Industries Ltd. a small coatings company based in Chateauguay, Que. This company specializes in manufacture and sale of floor coatings for gymnasium floors and exports the majority of its production to the U.S. market. Focusing on this market niche has enabled Adamin to develop an excellent reputation with flooring manufacturers in Canada and the United States.

Sub2 = Summary and conclusions
In summary, while markets for paint and coatings have not grown significantly over the past decade, the industry has been transformed in almost every imaginable way. Environmental legislation and awareness have resulted in the development of new products, based on new resins, new additives, and new application techniques.

The markets for paint and coatings in Canada have changed. There is now much greater impact by U.S. paint companies on the prices, quality and marketing in Canadian market. FTA and, in future, NAFTA, have, and will continue to, speed up the process of 'North Americanization' or globalization of the industry. The only response for Canadian based producers, be they foreign or Canadian owned is to act decisively. CM

APPENDIX D2

REPRINT FROM COATINGS MAGAZINE

“MANUFACTURING COMPETITIVENESS --

IS OUR PLAYING FIELD LEVEL?”

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THE
JOURNAL OF THE
ROYAL ANTHROPOLOGICAL INSTITUTE
OF GREAT BRITAIN AND IRELAND
PUBLISHED BY THE
LONDON AND WINDSOR PRINTING CO. LTD.

Volume 71
Part 1
1941
No. 1
January 1941

Competitiveness

Manufacturing competitiveness - is our playing field level?

by C.H. Kaufmann, Jacob Shapiro,
& L.H. McEwan

Special to Coatings Magazine

In *Coatings Magazine* (November-December, 1992) Dr. J. Shapiro et al discussed the competitiveness of the Canadian paint industry. The focus was on the Free Trade Agreement (FTA), the forthcoming North American Free Trade Agreement (NAFTA) and the implications for the markets and customers.

This paper focuses on the manufacturing sector. It compares Canadian and U.S. paint manufacturing and provides some views on the opportunities and challenges in this area. Although Mexico will be an important part of the North American Free Trade Agreement, sufficient information has not yet been obtained by the authors to make the desired detailed comparisons. It is obvious, however, that the Mexican factor cannot be ignored in developing a fully satisfactory strategy. This is true both in terms of opportunities as well as challenges in the marketplace. For the time being, however, the Canada/ U.S.A. competition is the main arena for our attention.

Competitiveness is very much in the forefront when government, financial and commercial sectors discuss the opportunities and challenges facing Canadian business. Indeed, the enthusiasm for the North American Free Trade Agreement is predicated on the belief that Canadian industry can and will effectively compete in this market.

Assured opportunity for entry into this vast trading area and the provision for a "level playing field" with an equitable mechanism for the settlement of any disputes have been promulgated as equally important pillars of the agreement. However, all parties do not have the same view of what constitutes a "level" playing field. Inevitably, there is a focus on the perceived inequities as practiced by the other members of the agreement.

Further, the need for rapid settlement of disputes and avoidance of harassing tactics are still wishes and not facts. One need only to consider U.S. and Canadian actions to protect "injured" industries (pork and "environmental" taxes on beer cans) for proof.

Be that as it may, the global trends to geographic trading blocs are with us for the foreseeable future. The fact of the matter is that an enormous market com-

In many ways the tables seem stacked against Canadian paint makers facing competition from the South under free trade. If we are to succeed and survive, there are a lot of negative factors that will have to be offset, including scale of operations, productivity and the cost of materials.

petitor is close at hand. Strategically, our resources in energy, minerals and water may be the goal, but the business opportunities will not be ignored.

We will be a particularly inviting target if our industries are inefficient and unaggressive competitors. It is crucial for our future well-being, therefore, that Canadian businesses develop strategies and pursue initiatives which will ensure an acceptable share of the industrial and commercial segments of the North American business.

Manufacturing Competitiveness

In any consideration of manufacturing competitiveness, five elements bearing on cost must be taken into account. These are:

- 1: Scale of operations;
- 2: Efficiency of operations;
- 3: Cost of materials;
- 4: Cost of labor
- 5: Indirect costs.

We will provide some comparisons of Canada and the U.S.A. for these elements and suggest means of maximizing areas of strengths, both current and potential.

Scale of Operations

The paint manufacturing process today is almost entirely a batch process. While some intermediate operations can be continuous, limitations on end product volume requirements and, to a lesser degree, on available and viable engineering technology, have made the batch process prevalent.

When considered simply in terms of direct manufacturing costs, it is obvious that a single large batch is lower in cost than the same volume made as a number of smaller batches. Multiple batches require multiple set-up times, quality testing and adjusting, for example, all of which are essentially independent of batch size. Higher costs for large batches for pigment dispersions, mixing, filling and packaging operations, however, are unit based; that is gallons, liters or containers. They are, therefore, independent of batch size.

Available data suggests that the average size of paint manufacturing plants in Canada and the United States is quite comparable, and that the Canadian disadvantage is relatively small. According to statistics for 1989, the average paint plant in Canada produced approximately 2,700,000 liters while the average for U.S. plants was 2,900,000 liters, or about 8 per cent more per plant.

In these terms, the difference could not be considered an insurmountable obstacle to the achievement of a competitive position. The situation, however, is not quite so simple. A much higher proportion of paint companies in the U.S. have multi-plant operations; there are 1,400 plants representing 1,030 companies. In Canada, by contrast, the 146 plants represent 135 companies. While the direct effect of multi-plant operations on batch costs is

not large, the effect on indirect costs is much larger.

Recognition must also be made of the fact that a significant number of the multi-plant companies operating in Canada are part of larger multi-national organizations, which also operate in the U.S.A. Indeed all, in terms of the North American market, are based there. Although Canadian branch plants are not precluded from competing in the parent company's home market, such competition would be accepted only on the basis

Manufacturing only to meet customer demand is one way to offset the negative effect of economies of scale.

But an even bigger problem is that Canadian productivity is just 43 per cent that of the United States on a volume per employee basis!

of a perceived economic benefit, something which the data suggest is currently unlikely. On the contrary, the economic pressures would support a rationalization of production facilities in favor of the larger U.S. plants if the decision were based solely on economy of scale benefits.

All in all, the evidence strongly supports the view that the economy of scale factor is heavily tilted in favor of U.S. producers and if Canadian producers are to be competitive, they will, over the near term at least, have to achieve that status through other means.

Efficiency of Operations

The economy of scale factor, as stated above, is a negative one. It is one that is not readily changed. Fortunately, it is not the only factor in the equation.

The efficiency of operations factor offers the possibility of restoring a measure of balance. While a large batch will inherently be cheaper to produce than a small batch, it will not necessarily have the lowest overall cost.

Inventory turnover can be very strongly and adversely affected by manufacturing large batches which are grossly in excess of product demand. High stock turn-over has real direct and indirect cost benefits. These include:

- Lower costs for raw materials, intermediates and finished goods inventory;
- Lower obsolescence write-offs;
- Improved quality;
- as made because of the ability to upgrade manufacturing formulas and

processes when developed

— as shipped because of reduced product aging

— better customer service because of the ability to meet changed customer requirements; and

— reduced capital costs because of smaller facility and warehouse requirements.

Of course, none of these offsetting benefits will be easily achieved. They are, at least, more realistic and achievable than matching much larger competitors' economy of scale.

Cost of Materials

In dollar terms, the differential in output between U.S. and Canadian plants is about 3 per cent. The reduced differential, when compared to volume output between average plants in the two countries, comes about because the average dollar value per liter is \$4.23 for Canadian shipments and \$3.49 (-17.5 per cent) for U.S. shipments.

Part of the differential may be rationalized on the basis of higher raw material costs. A "Paints and Coatings Industry Profile" by John Margeson of the Materials Branch, Industry, Science and Technology Canada, estimates a 5 per cent differential in raw material costs. This probably translates into a 2.5 per cent difference in finished product cost.

Another interpretation of the available data suggests that the differential is much larger if considered in terms of the final product as shipped. It could be as high as 20 per cent of the shipment value. This may be attributed, in part to:

- Higher selling prices for smaller quantities or containers;
- Increased losses during manufacture because of smaller batches;
- Duties; and
- Freight, because of longer shipping distances from supplier to user.

It is interesting to note that if this 20 per cent reduction were translated directly into a reduction in value shipped, the Canadian unit value would drop to \$3.38, 3.2 per cent below the unit value of U.S. shipments. A word of caution must be stated here. The above information is based on extrapolation of incomplete data. Nevertheless, whatever the differential is precisely, it is not a favorable one for Canadian manufacturers.

Cost of Labor

The comparative data on wage costs provides a mixed scenario. The average hourly rates for Canadian and U.S. paint production workers are \$13.17/hour and \$14.53/hour respectively. This favorable aspect is more than offset,

however, by the much higher productivity of the U.S. worker. The latter produces an average of 67.1 liters per man hour, compared to an average of 28.975 liters per manhour for his Canadian counterpart.

As production labor represents about 7 per cent of the value of shipments, the absolute effect is considerably diminished. The inescapable conclusion is, however, that U.S. production worker cost/liter is less than half the Canadian cost (\$0.22 vs \$0.46).

As might be expected, analysis of total salaries and wages provides similar results. The Canadian paint companies produce only 43 per cent of the U.S. volume per employee (16 liters/man-hour versus 37 liters/manhour) and given the comparability of salaries, Canadian costs are more than double the U.S. salary and wage costs per liter (\$1.03 and \$0.47). Much of this differential can be attributed to the economy of scale advantage enjoyed by U.S. manufacturers.

The message is that unless Canadian manufacturers take all measures available to them to restore balance, they will be overwhelmed in their own domestic market. Even so, the case may appear hopeless.

That does nothing to lessen the need to face up to it and deal with it if Canadian industry is to survive, let alone compete.

Indirect Costs

The indirect cost advantages accruing to multi-plant companies have already been mentioned. These advantages are primarily in costs not directly related to production; viz. marketing and advertising, research and development and finance such as credit, invoicing. There are also opportunities to gain functions, concessions based on large volume purchases and specialization of other resources. Generally speaking, advantages which accrue from functions which can readily be centralized will go to the larger competitor.

Options for Canadian Paint Manufacturers

Although based on partial data, the analysis is sufficiently precise to be sure that Canadian paint manufacturers are at a serious disadvantage compared with their U.S. counterparts. The message to be received is that unless Canadian manufacturers take all

measures available to them to restore some semblance of balance in the competitiveness equation, they will inexorably be overwhelmed in their domestic market. The deterioration may not be a rapid one at first, but it will gather momentum as the loss continues.

Given the impossibility of altering the relative size of the two domestic markets with the attendant advantages accruing to the U.S., the case may appear to be hopeless. The analysis, however, is based on averages for the industry and is limited in usefulness as the sole arbiter of the situation.

In both countries, very small companies co-exist with very large ones. In a sense these multi-plant producers and single plant companies represent a microcosm of the lop-sided competitive position of the Canadian paint industry attributable to differences in size between Canada and the United States.

From that perspective, they also offer possible guides for the survival and competitiveness of the Canadian paint industry. Clearly, some smaller companies survive and prosper in competition with much larger companies.

The reasons for these successes in the

face of reason and logic lie in the recognition and exploitation of those advantages which the particular company possesses.

Perhaps the first rule is to compete in the niche selected by the smaller company. Obviously, there must be a clear understanding of that niche and its requirements. In the end, it is the customer who determines the ultimate success or failure of an enterprise. Fulfilling all of the customer's requirements including:

- Performance to expectations;
- Quality;
- Delivery;
- Price; and
- Service

is the key to survival and growth.

To successfully accomplish this, a clear understanding of the requirements is essential with the ability to meet those expectations by all of the operations in the organization — sales, marketing, financial, technical, manufacturing, warehousing and shipping.

These are all linked and while some customers will place a heavier weight on some aspects than on others, all must perform up to expectations. It is a key element that the manufacturer understand precisely what those customer

requirements are, and know absolutely that, as a supplier, they will be met. Wish lists and fantasy have no place in assessing that ability to meet the requirements. It is a truism that customers are exceptionally difficult to win but easy to lose.

From the manufacturing perspective, there are three key elements which must be in place for effective competition:

1. The marketing objectives must be clearly understood and the manufacturing operations, as well as all support operations, aligned to those objectives.

2. All facets of the manufacturing operations run as efficiently as possible, with close attention being maintained on key cost elements.

3. Innovative procedural and technological developments must be sought out and implemented.

It is essential that the functioning of the production unit be closely attuned to the customer's needs. It cannot be stated too emphatically that the company must have a clear understanding of its objectives, strengths and weaknesses. The book, "The Goal" by Eliahu M. Goldratt and Robert E. Fox, North River Press, is an excellent and concise discussion of the importance of corporate goals and objectives, their identification and development. It is recommended reading for anyone interested in developing and improving their business.

It follows that the manufacturing objectives, strengths and weaknesses must also be clearly understood. Using this knowledge, the functioning of the plant must be attuned to those objectives by meeting the customer needs in the target market.

There are several elements besides the lowest possible cost per gallon which can offset the inescapable adverse factor of economy of scale.

For example, if the customer's need is a range of products on short and unpredictable demand, rapid manufacture and shipment of the needed quantities on very short notice is essential. The answer is not larger batches and warehouse inventory, since the cost of such inventory is substantial, future demand is uncertain and aged stock may deteriorate in quality.

As another example, the customer may require differing container sizes at different times. Again maintenance of bulk stock is an expensive solution and will tie up production capacity in its manufacture. Murphy's Law will also ensure that the bulk stock is not the product required. The ability to respond to the customer's needs is crucial. Manufacturing and filling to the

customer's need will transcend price.

With the support of modern technical, planning and scheduling skills, it is possible to operate at inventory levels which, in the past, would have been impractically low. And, by inventory, one must include raw materials, work-in-process and finished goods.

Given the need to meet customer requirements on short notice and for a range of products, rapid production of precise quantities is essential. This can only be achieved if all elements are in place. These include:

- Precise formulations which can enable the manufacturing unit to always produce the required end product with the prescribed materials and operations;
- Manufacturing processes which are under control;
- A system assuring availability of intermediates such as tinters or other blends;
- A system for identifying, in advance, these requirements;
- Known, reliable lead times for all components from raw materials and intermediates down to containers and labels; and
- rapid delivery of raw materials as needed.

The capability of producing the

product by extended processing, or frequent adjustments, or addition of materials not originally called, for is definitely not acceptable. The objective is to assemble the ingredients using the

Controlling every manufacturing process is vital to the future. A couple of select companies in Canada and the United States demonstrate the point.

processing specified and produce the required end product the first time, requiring only confirmatory testing without further adjustment or repetitive testing.

Obviously, the above objective can only be achieved by careful planning, intelligent formulating and the use of the best in innovative technology.

There are many useful processes available to assist in arriving at the desired end result. The use of integrated planning and scheduling systems can be important tool in this regard. One of these systems with which the writers are personally familiar is Manufacturing Resources Planning II (MRP II).

MRP II was developed by the Ollie Wight Company and has been widely used in the manufacturing sector, including paint manufacturing, for some time. One of the Canadian companies which has practiced MRP II for some time is ICI Autocolor at its operations in Toronto. The use of MRP II enabled them to successfully introduce and integrate a large volume new product line into their operations. It also enabled the continued satisfactory supply of existing products during the inevitable changes introduced during this period.

This was possible because one of the major benefits of the system is the discipline, in the best sense of the word, which it can impose on the operation. Forecasting, planning, supply, formulations, manufacturing procedures and inventory were all brought under combined scrutiny. In the larger sense, the systems provide the mechanism for bringing all the operating elements together. Marketing, sales, technical, financial, planning, purchasing and manufacturing (including scheduling, works supply, operations, warehousing and shipping) to face the problems and the consequences of not correcting them. On occasion, the acronym MRP was said to stand for "Management

Runs the Place."

That is not to say that any of this is easily done, resistance to change being so strongly imbedded in human nature. Having brought the problems and conflicts out into the open for examination and resolution, however, their existence and the need for correction is much more difficult to ignore. And resolved they must be if the company is to remain competitive and meet its goals.

Of course, large companies can set and meet highly challenging goals. An example of this is the Valspar Corporation plant in Wheeling, Illinois.

While only a few Canadian manufac-

turers can even attempt to meet the scale of operations of this large American paint manufacturer, many can benefit from some of the technology and procedures used by this company.

This plant was designed for the free flow of materials on one floor instead of the top-down, three-floor design of 50 years ago. Raw materials, mostly in bulk or semi-bulk mode, are received and stored at one side. All liquids, be they latexes, resins or titanium slurries, are stored above ground inside the building. For water-borne products, this avoids problems of freezing and as the tanks are built, for most uses, of low cost

fiberglass, reduces capital investment. Dedicated piping and diaphragm pumps eliminate contamination. Metering is done volumetrically. Pumping is controlled by computers allowing for variable pumping rates and ensuring accuracy and repeatability still further. The receipt of high volume fillers in 1 ton bags provides accuracy of addition. Direct discharge into the twined 1500 gallon tanks is easily accommodated within the one story building height limitations. The pair of tanks lead to a single 10 HP. Hockmeyer mill for dispersion. Mixing tanks are 2000-10,000 gals. capacity, being square vessels with rounded corners to avoid dead spots.

Filling is done in rows parallel to the mixing "mezzanine," and are all visible to the supervisor so that any problems can be dealt with as soon as they occur. The containers filled range from 1/16 to 5 gallons with a surprisingly large percentage taken up by the latter size. A war on waste is carried on relentlessly. The lids, for example, are delivered in 'Sono'-like tubes which are returnable to the container supplier. High speed case packers, using flat sheets, are used based on designs from the frozen food industry. Obviously, a willingness to borrow from elsewhere is a characteristic of the best in competitive industries, no less in the U.S.A than in Canada.

A key feature of this plant is turnover. Raw material turnover, for example, averages 30 times per year. All formulae are designed to give no more than 24 hours residence in any tank. Everything including control tests are designed to comply with this regimen.

The rapid turnover, however, is targeted at more than meeting the manufacturing unit's objectives; the customer's needs always being in the forefront. In most paint stores, sales are concentrated at the weekends. Order receiving and processing are therefore designed to accommodate this. The bulk of the orders are received by electronic links on Sunday night. These are filled by Wednesday and shipped for delivery by Friday. In addition to large volumes manufactured, the plant also operates on very low inventories and still achieves 98 per cent of orders shipped within three days.

Only a limited number of Canadian manufacturers can achieve the sort of volume which is produced by this facility. Every company, however, can examine their own operations and their customers and target markets and introduce changes designed to bring about

that type of efficient and competitive operation.

Home Hardware's paint plant in Ontario is an example of a firm that has met the challenges and looks forward confidently to the future!

An example of a Canadian company which has met past challenges and is looking confidently forward to meeting them in the future is the paint plant of Home Hardware's Paint and Chemical Division, located in Burford, Ontario. The operation of this plant is very clearly focussed on its customers and their needs. All of the staff including Jamie Kent, General Manager, Richard Luszczyk, Dealer Service Development Manager and Catherine Currie, Chief Chemist, obviously strive to that end.

As with the U.S. plant described above, the Burford plant is a single floor design with raw materials entering at one end and finished product being shipped at the other. Inventories are minimal and stock turnover is said to be better than 20 times per year.

Efficient materials handling is a key facet of the operation, with metered additions of liquids and slurries the norm. Extensive use of computers is made in controlling raw materials, scheduling and automating the manufacture of batches, as well as filling customer orders. It is an interesting and pertinent point that "user-friendliness" was an important criterion in selecting the computer systems used in the Home Hardware plant. Productivity, as might therefore be expected, is high and well above the Canadian average with costs correspondingly low.

Quality is also a key concern of the technical staff. Stringent quality tests are done on all raw materials before they are accepted into the plant, before batches are filled, and again before the material is placed in inventory.

Prevention of customer complaints is obviously seen as an essential way of ensuring repeat customers. Dealer training is also extensive to enable the retailer to provide proper guidance to the end user. When touring this plant, it quickly becomes apparent that there is a genuine sense of meeting the customer's needs in every one in every area.

The final message is to prepare carefully and plan thoughtfully and intelligently for the future.

Also in the November/December issue of Coatings Magazine (p.71) the

speech by Jerome Crowley, president and CEO of the O'Brien Corporation and a past president of the NPCA, was reported. Mr. Crowley's talk addressed itself very much to the point of competition and the challenges which the paint industry faces.

It was, naturally, given from the U.S. perspective and was both a challenge and a warning. According to Mr. Crowley, the companies who will survive and prosper will be those that focus on identifying their target markets and serve them as best they can.

Quite specifically, he noted that protective barriers are gone, that tough competition is the order of the day and that U.S. companies have their eyes on opportunities in Canada (as well as in

their own markets).

The U.S. companies are going to aggressively defend their own market position and equally aggressively pursue new markets internationally.

What clearer challenge could be placed before the Canadian paint industry? It faces each member of that community squarely.

Those that rise to the challenge will survive, those who do not, will not.

It's that simple. CM

Our authors are consultants from the Toronto area experienced in the paint and coatings industry. This is the second of three parts on competitiveness in the Canadian paint industry with free trade.

APPENDIX D3

REPRINT FROM COATINGS MAGAZINE

“COATINGS RESEARCH WILL BE KEY TO SUCCESSFUL COMPETITION”

Free Trade

Coatings research will be key to successful competition



If the Canadian paint industry is going to succeed in competing with the United States under free trade, then it is going to need considerable research effort, say our consultants. In this, the final segment of a three-part look at Canadian competitiveness in the new global markets.

One important opportunity would be found in the establishment of a quasi-official paint research institute on the lines of those in Europe.

by Ian H. McEwan, Jacob Shapiro, and C.H. Kaufmann.

This is the third of a trio of papers forming an assessment of the competitiveness of the Canadian Paint Industry. This paper will focus on R&D in the post Free Trade Era as NAFTA looms larger on the horizon.

Like all industry, the Paint & Coatings Industry is only as competitive as its component parts and, in this case, it is like a three legged stool, balancing on marketing, manufacturing and R&D. The Canadian scene must be viewed in the context of the world scene, since, as the first paper showed, this is increasingly global in nature.

The formulation of resins and coatings

Table One Air Quality Issues

History

- Early 1960's: California. Los Angeles "smog" ozone as respiratory irritant
- Rule "66": "Some solvents are photoactive: Xylene 3.5 x Hexane limited to 6%

- July 1988: L.A. Rule 1151
- June 1989: Bay Area Rule 45

U.S. Federal Activity

- 1970 Clean Air Act
- 1977 Amendments
- 1990 November Amendments
recognizes that earlier objectives could not be realized more prescriptive than 1977.

over at least the last decade has been in ferment as seldom before.

Normally this is a conservative industry, content with its technology and with nickel and diming its way to a lower cost Nirvana. For, of course, raw material costs are the biggest cost component aren't they? We can only compete by lowering prices, can't we?

This is the way to oblivion, not Nirvana!

The engine driving change has been the increasing concern with the environment and the detrimental role played by Volatile Organic Solvents used in coatings. The United States was the first country to legislate in this area. That initiative came from Los Angeles and continues as shown in the summary below:

Research has shown that ground level ozone is the irritating factor in smog and that this stems from the interaction between VOCs (solvents), nitrogen oxides (combustion and fertilizer by-products) in the presence of the UV in sunlight. In the United States this has given rise to "mandated" solvent contents of as low as 3.5 lbs. per US gallon, from levels in excess of 6 lbs. per gallon. The target is to reduce ozone to 120 ppb., which is the onset level for respiratory effects during

exercise, from the 280 level reached in the Los Angeles area.

Canada has only lately considered controlling emissions, but Canadians will not escape this "race," since the Canadian Council of Ministers of the Environment Management Plan dated November 1990 sets the target at 82 ppb. However we will likely escape the complex web of mandated VOC levels.

One result of this late entry into Environmental control seems to be the lack of a fillip given to R&D which was evident in the United States. This may be reflected in a comparison of the statistics in regard to R&D Expenditures as a proportion of sales given in Tables 2 and 3.

The statistics may not be strictly comparable, but are sufficiently so that valid inferences can be drawn for present purposes.

These figures show that expenditures in the U.S.A. were double the equivalents in Canada!

If the figures for trade sales are deducted, then the remainder gives 3.2% versus 1.5% or more than double. In actual dollar terms, this is likely 25-30 times more!

Several other factors come into play here:

Table 2

R&D expenditures as a proportion of sales (Canada)*PCPA survey results 1990*

All companies (15 participants)	1.1%
Companies with sales over \$25MM (4 participants)	0.9%
Companies with more than 70% trade sales (7 participants)	0.6%

Multi-national companies with operations in both countries may concentrate their R&D in the U.S.A as pointed out in the previous papers in this series. (In 1990 this was not so in all cases).

Expenditures in the automotive sector are certainly more than 3-4% and the bulk of this (but not all during 1990) occurs in the U.S.A.

A reasonable inference to be drawn from this data is that "green concerns" in the U.S.A. have given a boost to R&D. Maybe environmental concern is good for the economy (of researchers at least!) after all.

This is not to say that Canadian R&D is blind to VOC issues as readers of Coatings Magazine will know. Some of the multi-national customers for coatings have insisted that suppliers conform to the same constraints they face in their home country even where

there are the Industrial Research Assistance Programs. In some cases, provincial ministries have organized similar programs, but "double dipping" is not allowed.

Why don't these programs enjoy more popularity? The bureaucracy involved may be off-putting to some; the limited surrender of rights to others, or, perhaps, their existence is not all that well known or understood by the industry.

Other structural elements may contribute to the lack of support afforded R&D by the paint industry in Canada. These will include the multinational issue mentioned above and the lack of profitability in Canadian Industry—the Industry, Science and Technology Canada Paints and Coatings Industry Profile 1990-1991 shows that for the years for which figures are available, 1983-1987, profits ranged from 6.8-

Table 3

R&D expenditures as a proportion of sales (U.S.A.)*NPCA survey results 1990*

All companies (108 participants)	2.7%
Companies with sales over \$ 20 MM (39 participants)	2.2%
Companies with more than 70% trade sales (27 participants)	1.3%

specifications are not explicit on the issue—IBM as only one example.

These statistics fly in the face of the generous scientific tax credit system enjoyed by Canadian industry. Even the work resulting from funds contributed by a parent company outside Canada is eligible for credit against profits made within Canada. In some cases, such funds are also eligible for any credits in the country of origin.

There are also assistance schemes over and above the tax credits, though they are not additive. For instance, the federal Department of Energy Mines and Resources gives funding for implementation of developments under the Energy Saving mandate. Eligibility would come from lowering baking temperatures or from the energy equivalents derived by saving solvent—otherwise known as VOCs. Then

10%, averaging 8.3%.

It was not always so, indeed Canada has a proud history of achievement in coatings research. For instance, pioneering in vinyl acetate emulsions (Shawinigan Chemicals), thermosetting acrylics (Canadian Industries Ltd.), and more recently, waterborne automotive basecoats (C.I.L.) and non-isocyanate thermoset acrylics (Guertin Bros. Coatings and Sealants).

Of course, Canadian companies have not ignored the trend to low VOC coatings, but the point is that the urgency, the dynamic thrust to conform, has been missing.

It is interesting to note that in the recent innovations noted above, the need to change was there. For C.I.L., the customer was moving to VOC conforming coatings in Canada and the issue of health hazards for isocyanates is very

strong in Canada.

Formulation of VOC conforming resins for coatings is a real intellectual challenge.

It can be seen from Figure 1 that the best formulating region for resins with respect to the ease of application, which is viscosity dependent, lies in the low molecular weight region, whereas the best region for durability and toughness resides in the high molecular weight zone.

For low VOC or high solids, low molecular weight is demanded. The compromise is demanding. Waterborne resins can be both high in molecular weight and low in viscosity (emulsions, for instance), but the requirements for water resistance and rapid dry pose a formidable challenge.

Canadian companies must respond to the challenge, not only to respond to reductions in VOC emissions at home, but also to be able to export to the major markets now open to them under the free trade pact.

Some of the universities in Canada are doing the sophisticated type of work necessary. These include McMaster, Toronto, Waterloo and Ecole Polytechnique at the Universit  de Montreal.

Professor Schreiber at the latter is using acid/base relationships to clarify physico-chemical aspects of interactions in coatings. This is relevant to pigmentation and polymer plasticization processes.

At the University of Toronto, Professor Winnik is using fluorescence methods to examine latex particle-particle interactions, interpenetration and plasticizing action.

The McMaster Institute for Polymer Production Technology (MIPPT) under the direction of Professor Hamielec is world renowned for polymer simulation work, particularly as related to continuous polymerization of addition polymers, including latex polymers. Studies relating physical properties of polymers to production processing parameters are also underway, but not as yet for coatings directly.

At Waterloo, Professor Penlidis is also engaged in polymer production and process work, including latex polymers, and is extending this to include the effect of polymer process variables on coating properties with statistical methods. Professor Rudin is also well known for his work at Waterloo in resin synthesis and paint formulation. Professors Rudin, Schreiber and Winnik have won Roon awards at the annual Federation of Societies for Coatings Technology meetings.

the improvement of the process operations in production.

Efficient production calls for elimination of scrap: the cost of rework is not merely raw material recovery, but the extra time that work is in progress and the extra inventory cost of holding those materials, as well as the opportunity time lost and direct labor expense. Inventory costs associated with Work In Progress (WIP) is not always taken into consideration.

An important observation can be made re production techniques and Just in Time modes.

Almost without exception, paint processes do not aim at being Right First Time. They aim at being close and then adjusting, be it for color, viscosity, solids, etc.

The delays built in by the rounds of adjustments are considerable and extend cycle times, lead to poorer equipment utilization and costs of WIP. Better equipment is now available to enable highly accurate loading of carefully controlled ingredients. Thus color matching first time is possible.

Currently this is achieved mostly, if not exclusively, with controlled liquid tinters. The challenge is to do this with powdered pigments and other ingredients — a challenge for paint technicians and the suppliers of powdered additives. Can they control strength or activity of powders? If not, why not? Can additions of powders to batches be automated to a high order of precision?

Another technical challenge is to look ahead and anticipate change, both societal and technical. Society increasingly demands responsible manufacturing operations, minimizing waste and irresponsible or profligate use of resources. Waste disposal is a current example. The 3R's have a new meaning today, what lies down the road?

Techniques developed outside the industry will continue to be applicable as well as the need to cast a wide net to catch these ideas. Working with universities for example.

Can the funds now available from government be better targeted?

It would be surprising if this were not the case!

Pre-competitive research is assisted quite well but the application of this research to industry could be improved.

Many European Countries have quasi-official paint research institutes. The idea seems not to have caught on here but it seems to be a natural for Canada. Surely it would help the small scale companies that cannot afford the "R" in the R&D equation; or if they have any "R," the resources devoted to it are so small that the chance of establishing a critical mass is impossible.

Industry, its associations and government should get together to explore such an institute and ways that this might be funded jointly.

This article has presented a provocative view of the state of the art of R&D in the Canadian coatings scene. The authors welcome other opinions, pro or con, and evidence that the views presented are too pessimistic.

Our authors are consultants from Toronto experienced in the paint manufacturing industry. CM

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APPENDIX E

E1: EQUIPMENT MANUFACTURERS BY NAMES AND EQUIPMENT TYPES

E2: EQUIPMENT MANUFACTURERS BY NAMES AND ADDRESSES



APPENDIX E1

EQUIPMENT MANUFACTURERS

BY NAMES AND EQUIPMENT TYPES

ADHESIVES AND PAINT & VARNISHES

(EXCERPTS FROM COATINGS MAGAZINE

JANUARY/FEBRUARY 1994)



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THE SOUTHERN
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Section Two

PAINT AND COATINGS MANUFACTURING EQUIPMENT

A

ABRASION RESISTANCE TESTERS

Atlas Electric
J.B. Atlas
Cascade
Custom Scientific
Geneq
John Herring
Paul N. Gardner
Testing Machines
Zorelco

AIR POLLUTION EQUIPMENT

ABB Air Preheater
Adwest
Automated Systems
Can-Am
Durr
Eisenmann
Fab. Plastics
Farr
Fryson
Geneq
Giffin Contractors
Hosokawa
Huntington Energy
McCarthy Robinson
Metcalf & Eddy
Norspec
Omega Recycling
PAP Engr.
Pneumafil
Reeco
Trell Services
United Air Spec.

ANALYTICAL INSTRUMENTS

Analytical Meas.
J.B. Atlas
Automation Products
Bacharach
C.W. Brabender
Cancoppas
Cascade
Cedco
CVC
Folio Inst.
Geneq
Hadley Tekscience
Horizon

LaMotte
Markland
Millipore
Onior
QC Inst.
Solomat Inst.
Spectra-Tech

ATTRITORS

Taylor Stiles
Union Process

B

BLENDEES

Automation Products
Bowers
C.W. Brabender
Can-Quip
Cascade
Charles Ross
Cornell
Draiswerke
Epworth
Fryma
H.B. Fuller
Geneq
Greco Lightnin
Hayward Gordon
Hockmeyer
Horizon
Hosokawa
Jaygo
Kinetic Disp.
Kirk Equip.
L.V. Lomas
Micco Dist.
Millar-Williams
Morse
Netzsch
Norspec
Patterson Ind.
Paul O. Abbe
Premier Mill
Prism
Prism Powder
Prochem Mixing
Schold Machine
Shadrack
Teledyne Spec.
Westglen

BULK HANDLING BAGS

Automation Products
Clawson Tank
Emchem Sales
Graco
L.V. Lomas
Semi-Bulk
Shadrack
Syn-Tex
Unisource

BULK HANDLING EQUIPMENT

Buhler
Delta Equip.
Fining
Fred Cressman
Hoover Group
L.V. Lomas
Masdom
Peacock
Semi-Bulk
Shadrack
Stiefel Niagara
Vac-U-Max
York Belting
York Fluid

C

CAN

1, Coding Machines
3, Feeding Tables
4, Filling Equipment
5, Labelling Equipment
6, Securing Clips
C.M. Ambrose 3, 4
Cascade 1, 3, 4, 6
Chisholm Mach. 3
Graco 5
L.V. Lomas 1, 3
Markem 1
Micco Dist. 1, 3, 4
A.S. Paterson 6
Ragogna 3, 4
Unisource 5
Universal Air 1

CASE SEALERS

Chisholm Mach.
Lion Shipping
L.V. Lomas
3M Canada
Micco Dist.

Unisource
Universal Air

CHAMBERS

1, Humidity
4, Light
2, Temperature
3, Salt Spray
Atlas Electric 1, 2, 3, 4
J.B. Atlas 1, 2, 3
Cancoppas 1, 2, 3, 4
Cascade 1, 2, 3, 4
Cedco 1, 3, 4, 4
Chemroy 1, 3, 4
Enthone-Omu 3
Folio Inst. 1, 2, 3
Geneq 1, 2, 3, 4
Giffin Contractors 1, 2, 4
Hamilton Thermal 1
Heraeus DSET 4
John Herring 1, 2, 3
Horizon 1, 3
K.H. Huppert 2
Ind. Filter 4
Lab-Line 1, 2, 4
Park Thermal 1, 2, 3
Q-Panel 1, 3, 4
Singleton 1, 2, 3

CHILL ROLL ASSEMBLIES

Prism
Prism Powder

CLARIFIERS

Aimark Travers
Alfa-Laval
Greco Lightnin
Millipore
Shadrack

CLASSIFIERS

Geneq
Hosokawa
Shadrack
Vortu-Siv

CLEANING EQUIPMENT, Tank & Drum

Bowers
John Brooks
Can-Quip
Cascade
CB Mills

Crest
Graco
Hockmeyer
Hoover Group
L.V. Lomas
Mico Dist.
NLB
PAP Engr.
Polyquip
Unisource
Vac-U-Max

COLORANT/TINTING EQUIPMENT

Bowers
Cascade
Charles Ross
Datacolor
Fluid Mgmt.
Graco
Hero
Hockmeyer
Prism
Prism Powder
Ragogna

COLORIMETERS

J.B. Atlas
Cascade
Cedco
Chisholm Mach.
Crisenon
Folio Inst.
Geneq
Hadley Tekscience
Horizon
LaMotte
Macbeth
Minolta
Norspec
Paul N. Gardner
Testing Machines

COLOR

1. Cards
2. Computer Systems
3. Selector Guides
4. Standards
J.B. Atlas 1, 2, 4
BDH 4
Cascade 1, 3, 4
Color Corp. 1, 3
Datacolor 2
DSA 2
Duha Color 1, 2, 3, 4
Folio Inst. 2, 4
Geneq 2
Hadley Tekscience 2
Horizon 2
Macbeth 1, 4
McCorquodale Color 1, 3, 4
Microcolor 1, 3
Norspec 2
X-Rite 2

COMPUTER SOFTWARE

1. Color Matching
2. Formulating
3. Production
4. Inventory
5. Regulatory Compliance
Cedco 1, 3
Colorgen 1
Datacolor 1, 2
DSA 1, 2
Folio Inst. 1, 2
Hadley Tekscience 1, 2
Horizon 1, 2, 3, 4
Huntington Labs. 4
Macbeth 1, 2

Minolta 1, 2, 3
Norspec 1
Ontor 3
Pacific Micro 2, 3, 4, 5
Prism 2, 3, 4
Trivalent Data 5

CONSULTANTS, MANUFACTURING

Automated Systems
Casper
DL Labs.
DSA
George Koch
Mico Dist.
Orr & Boss
Ortech
Premier Mill
Prism Powder

CONSULTANTS, REGULATORY COMPLIANCE

Adwest
Durr
Fin. Engr. Serv.
Manchester
Metcalf & Eddy
Ortech

CONTROLS PROCESS

Adwest
Automated Systems
Badger Meter
Can-Am
Cancoppas
Cedco

Delta Equip.
Draurwerke
Durr
Eclipse
Gen. Fabrications
Hamilton Thermal
Honeywell
Mico Dist.
Millipore
Norspec
Ontor
Powers Process
Process Tech.
QC Inst.
Schlumberger
Simpson Electric
Treil Services
H.O. Trelice

CONTROLS REMOTE

Automated Systems
Badger Meter
Baker Inst.
Burling Inst.
Cdn. Meter
Cancoppas
Gen. Fabrications
Hamilton Thermal
Higginson
Honeywell
Markland
Mico Dist.
Ontor
Powers Process
Rousseau Controls
United Electric
Westinghouse

CONTROLS, TEMPERATURE

Automated Systems
Baker Inst.
Burling Inst.
Cancoppas
Cedco
Eclipse
Geneq
Gen. Fabrications
Hamilton Thermal
Honeywell
Jordan Valve
LCI Corp.
Maxitrol
Mico Dist.
Norspec
Powers Process
Process Tech.
QC Inst.
Simpson Electric
Treil Services
H.O. Trelice
United Electric
Westinghouse

CRYPTOMETER

J.B. Atlas
Geneq
Paul N. Gardner

D

DEHUMIDIFIERS

Cedco
Williams & Wilson

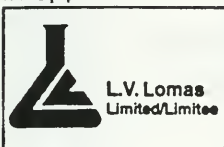
DEWATERING DEVICES

Alfa-Laval
Cedco
Delta Equip.
Gen. Filtration
Ind. Filter
L.V. Lomas
Netzsich

DISPERSERS

Bowers

Buhler
Caframo
Can-Quip
Cascade
Cedco
Charles Ross
Conn & Co.
Cornell
Draiswerke
Eiger Mach.
Emchem Sales
Epworth
Firing
Folio Inst.
Fryma
Hockmeyer
Horizon
Huntington Labs.
Jaygo
Kinetic Disp.
Kirk Equip.



L.V. Lomas
Mico Dist.
Mixmor
Netzsich
Patterson Ind.
Paul N. Gardner
Premier Mill
Prism
Prism Powder
Ragogna
Schold Machine
Shadrack
Sigma
Sonic Corp.
Union Process
Westglen

DISPERSER BLADES

Bowers

Can-Quip
Cascade
Cedco
Charles Ross
Conn & Co.
Draiswerke
Eiger Mach.
Emchem Sales
Epworth
Hockmeyer
Horizon
Kinetic Disp.
L.V. Lomas
Mico Dist.
Mixmor
Paul N. Gardner
Premier Mill
Prism
Prism Powder
Ragogna
Westglen

DISSOLVERS MIXERS

Bowers
Caframo
Can-Quip
Cascade
Cedco
Charles Ross
Conn & Co.
Dayton Rogers
Delta Equip.
Draiswerke
Eiger Mach.
Emchem Sales
Epworth
Firing
Fryma
Greedy Lightnin
Hayward Gordon
Hockmeyer
Horizon
Hosokawa
Jaygo
Kinetic Disp.
Lab-Line
L.V. Lomas
Mico Dist.
Millar-Williams
Netzsich
Norspec
PAP Engr.
Patterson Ind.
Paul N. Gardner
Premier Mill
Prism
Prism Powder
Prochem Mixing
Ragogna
Schold Machine
Semi-Bulk
Shadrack
Sonic Corp.
Teledyne Spec.
Westglen

DISTILLING EQUIPMENT

Bowers
Cedco
CB Mills
Crest
CVC
Horizon
L.V. Lomas
Mico Dist.
Osmonics
PAP Engr.
Prism Powder

DRIERS

1, Compressed Air
2, Desiccant
3, Gas Generators
4, Refrigerated
5, Vacuum
Aimark Travers 1, 2, 4
Arrow 1, 4, 4
Automated Systems 1, 2, 3, 4
Can-Eng 4
Cedco 1, 2, 3, 4, 5
Compair 1, 2, 4
Delta Equip. 1
Draiswerke 4
Gasmac 2, 3
Gen. Fabrications 1, 4
Hankison 1
Hiross 1
Lab-Line 2
Logan Actuator 1
Masdom 1, 2
McCarthy Robinson 2
Norspec 1, 2, 4
Novapro 1, 2, 4

Painronic 1, 4
Paul O. Abbe 5
Rousseau Controls 1, 2, 4
Treil Services 1
Reclaim Powder 2, 4
Wainbee 1, 2, 4
Wilkinson 2, 4
Williams & Wilson 1, 2, 3

DRUM & BUCKET HEATERS

Cascade
Hamilton Thermal
Lion Shipping
Millar-Williams
Morse
Prism Powder

DRUM ACCESSORIES

Cascade
CDF
Delta Equip.
Higginson
Hunter Drums
Jaygo
Lion Shipping
Morse
Paul N. Gardner
Prism Powder
Syn-Tex
Westglen
York Fluid

DRUM LIFTS HYDRAULIC

Chisholm Mach.
Higginson
Lion Shipping
Morse
Rousseau Controls
Shadrack
Williams & Wilson

DRUMS, PLASTIC

Anachemia Ltd.
CDF
Fab. Plastics
Horizon

DRUMS, Steel

Anachemia Ltd.
CDF
Clawson Tank
Comet
Crown Cork
Horizon
Hunter Drums
Ind. Containers
Nampac

E

ENVIRONMENTAL CONTROL EQUIPMENT

Adwest
Airflow
Analytical Meas.
Automated Systems
Can-Arm
Cancoppas
Cedco
Colloid Env.
Durr
Eisenmann
Fab. Plastics
Farr
Fryson
Geneq

Gen. Fabrications
Giffin Contractors
Hadley TeleScience
Hamilton Thermal
Hosokawa
Huntington Energy
Lab-Line
Manchester
McCarthy Robinson
Onitor
PAP Engr.
Patterson Ind.
Pneumafil
Poly Prod.
Reeco
Shadrack
W.W. Sly
Treil Services
United Air Spec.
York Fluid

EXPOSURE TESTING SERVICES

Heraeus DSET
Q-Panel
Sub Tropical

EXPOSURE TESTING EQUIPMENT

Atlas Electric
J.B. Atlas
Cedco
Chemuroy
Heraeus DSET
Horizon
Ind. Filter
KTA-Tator
Metal Samples
Q-Panel
Sub Tropical

EXPOSURE TESTING SERVICES

DL Labs.
Metal Samples
Ontech

F

FANS EXHAUST

Alcore Fabricating
Automated Systems
Fab. Plastics
Fryson
H.B. Fuller
Gen. Fabrications
Hamilton Thermal
N.R. Murphy
Ritchey Supply
Thienca
Treil Services
Tri Lite
Universal Air

FEEDERS DRY & LIQUID

Cedco
Delta Equip.
Firing
H.B. Fuller
Geneq
Greedy Lightnin
Hayward Gordon
Masdom
Peacock
Prism
Prism Powder
Shadrack
Wallace & Tieman

FILLING AND CLOSING MACHINES

C.M. Ambrose
Bowers
Cascade
Cedco
Chisholm Mach.
Draiswerke
H.G. Kalish
L.V. Lomas



Micco
Netzsch
Ragogna
Semi-Bulk
Westglen

FILTER

1, Bags
2, Cloths
3, Presses
4, Tubes & Cartridges
Aimark Travers 3
Air Filter 1, 4
Automated Systems 1, 2, 3, 4
FCF-Bowers 2
Cancoppas 1, 3, 4
Chisholm Mach. 3
Cuno 4
Delta Equip. 1
Drake Water 1, 4
Dry-Con 1, 2, 4
Farr 1, 2, 4
Filterite Memtec 4
Fryson 1, 4
Gen. Fabrications 1, 4
Gen. Filtration 1, 2, 3, 4
Graco 1
Horizon 1, 2, 4
Hosokawa 1, 4
Ind. Filter 1, 2, 3, 4
ISP 1, 4
L.V. Lomas 1, 3, 4
3M Canada 1, 4
Masdom 1, 2, 4
Millipore 4
N.R. Murphy 1, 4
Netzsch 3
Newark Wire 1, 2, 3, 4
Norspec 1, 2, 3, 4
Omega Recycling 4
Ontor 1, 4
Osmonics 4
Pall 1, 4
PAP Engr. 1, 2, 3, 4
Peacock 1, 4
William R. Perrin 3
Pneumafil 1, 4
Ragogna 1, 3
Ritchey Supply 1
Star Systems 2, 3
Westglen 1

FILTERS

1, Chemical
2, Oil
3, Solvent
4, Water
5, Water, Effluent
R.P. Adams 1, 4
Aimark Travers 2, 2, 4, 4, 5
Apco 3
Automated Systems 1, 2, 3, 4
John Brooks 4
Camac 1

Cdn. Meter 1, 3, 4
Cancoppas 2, 3
Cuno 1, 2, 3, 4, 5
Drake Water 4, 5
Dry-Con 1, 2, 4, 5
Fab. Plastics 1
Filterite Memtec 1, 2, 3, 4
Gen. Fabrications 1, 4
Gen. Filtration 1, 4
Horizon 4, 5
Ind. Filter 4, 5
ISP 1, 2, 3, 4, 5
Kirk Equip. 4



L.V. Lomas 1, 2, 3, 4
3M Canada 1, 2, 4, 5
Mackenzie & Feimann 1, 4
Masdom 1, 2, 3, 4
Millar-Williams 1
Millipore 1, 2, 3, 4, 5
Norspec 1, 2, 3, 4, 5
Omega Recycling 2, 3, 4
Ontor 1, 2, 4, 5
Osmonics 1, 3, 4, 5
Pall 1, 3, 4
PAP Engr. 1, 2, 3, 4, 5
Peacock 1, 3, 4
William R. Perrin 1, 3
Plasmag Pump 1, 3
Star Systems 1, 3, 4
Universal Air 2
Van Waters 1, 4

Vort-Siv 1, 3
Wainbee 2
Westglen 1, 2, 3, 4, 5
Williams & Wilson 4

FIRE CONTROL EQUIPMENT

3M Canada
Wirt & Knox

FIRST AID SUPPLIES

3M Canada
Unsource

FITTINGS

2, Brass
3, Copper
4, Stainless Steel
5, Steel
Automated Systems 2, 4
Emcho Supply 2, 3, 5
Higginson 2, 4, 5
Kinetic Disp. 4
Shawflex 2, 4
Tri-Canada 4
Universal Air 2, 5
Wainbee 2

FLINT PEBBLES

Can-Quip
Epworth
Patterson Ind.
Union Process

FLOW INSTRUMENTS

Airflow
Automated Systems

Bacharach
Badger Meter
Baker Inst.
John Brooks
Can-Am
Cdn. Meter
Cancoppas
Cascade
Cedco
Delta Equip.
Fred A. Dunger
Edwards
Geneq
Greely Lightnin
Higginson
Honeywell
Horizon
Kirk Equip.
Liquid Controls
Norspec
Ontor
Paul N. Gardner
Peacock
QC Inst.
Schlumberger
Wallace & Tiernan
Westinghouse

FUME ELIMINATORS

Cedco
Durr
Eisenmann
Fab. Plastics
Hamilton Thermal
N.R. Murphy
Norspec
Reeco
Ritchey Supply
United Air Spec.
Williams & Wilson

G

GAUGES, GENERAL

Airflow
Baker Inst.
John Brooks
Cdn. NDE
Cedco
Chemroy
Delta Equip.
Frank J. Cox
Geneq
Higginson
Horizon
Norspec
Novapro
Ontor
Paul N. Gardner
Peacock
QC Inst.
Rousseau Controls
H.O. Terrie
Uehling
Wainbee
Wallace & Tiernan

GAUGES, THICKNESS

J.B. Atlas
Cdn. NDE
Cascade
Corrosion Service
Custom Scientific
DeFelsko
Geneq
John Herring
KTA-Tator
Paul N. Gardner
Testing Machines
UPA Technology
Zorelec

GLASS BEADS REFLECTIVE

Deane & Co.
Epworth
Geo. Olcott
3M Canada
Micco Dist.
Nettsch
Porters Ind.

GLASS SHOT

Can-Quip
CB Mills
Deane & Co.
Emchem Sales
Epworth
Jaygo
L.V. Lomas
Micco Dist.
Nettsch
Porters Ind.
Quackenbush
Ritchey Supply
Sigma
Williams & Wilson

GLOSSMETERS

J.B. Atlas
Cascade
Cedco
Criterion
Elcometer
Folio
Geneq
Hadley Tekscience
John Herning
Horizon
Minolta
Norspec
Novapro
Paul N. Gardner
QC Inst.
Zorelco

GLOVES INDUSTRIAL

Cedco
Deane & Co.
Geneq
Ritchey Supply
Unsource

GRINDING MEDIA

Can-Quip
Cascade
Cedco
CB Mills
Diamonite
Draiswerke
Emchem Sales
Epworth
Fryma
Geneq
Horizon
L.V. Lomas
3M Canada



Micco Dist.
Nettsch
Patterson Ind.
Paul O. Abbe
Paul N. Gardner
Porters Ind.
Quackenbush
Sigma
Union Process

GRINDING MACHINES

C.W. Brabender
Can-Quip
Cedco
Charles Ross
CB Mills
Deane & Co.
Eiger Mach.
Epworth
Fryma
Geneq
Giles Tool
Harper
Horizon
Hosokawa
Jaygo
L.V. Lomas
Micco Dist.
Nettsch
Paul O. Abbe
Prism Powder
Sigma
Sonic Corp.
Stephen Bader
Taylor Stiles
Union Process
Wainbee
Williams & Wilson

H

HAND CLEANERS

Deane & Co.
Dilmont
Huntington Labs.
Magnus
Unsource

HEAT EXCHANGERS

ABB Air Preheater
R.P. Adams
Adwest
Alfa-Laval
Automated Systems
Camac
Charles Ross
Delta Equip.
Dry-Con
Eclipse
Fryma
Gen. Fabrications
Hamilton Thermal
Hross
Ind. Filter
Jaygo
Kinetic Disp.
Lepel
Patterson Ind.
Paul Mueller
Process Tech.
Rousseau Controls
Trell Services
United Air Spec.
Williams & Wilson

HEATERS

1, Electric
2, Immersion
3, Jacket
4, Oil & Gas Fired
Automated Systems 1, 2, 4
Caframo 1
Can-Eng 2, 4
Can-Quip 2
Eclipse 2, 4
Emcho Supply 4
Gen. Fabrications 1, 2, 4
Giffin Contractors 4
Hamilton Thermal 1, 2, 4
Maxon 2, 4
Onor 2

Park Thermal 1, 2, 4
Patterson Ind. 4
Paul Mueller 2, 3
Prism Powder 1, 3
Process Tech. 1, 2
Pyronics 4

HOISTS, AIR & HYDRAULIC

Compair
John T. Hepburn
Higginson
Ingersoll-Rand
Rousseau Controls
Williams & Wilson

HUMIDIFYING EQUIPMENT

Chemroy
Giffin Contractors
Research Prod.

HYDROMETERS

Baker Inst.
Cedco
Geneq
Higginson
Horizon
QC Inst.

I

INDICATORS

Aldert
Analytical Meas.
Baker Inst.
Burling Inst.
Cedco
Dry-Con
Eclipse
H.B. Fuller
Geneq
Masdon
Onor
Peacock
Prism Powder
Pyrometer
QC Inst.
Simpson Electric

K

KETTLES

Cascade
Charles Ross
Clemmer
Jaygo
Kinetic Disp.
L.V. Lomas
Patterson Ind.

L

LABELLING MACHINES

Cascade
Chisholm Mach.
L.V. Lomas
3M Canada
Matthews
New Way Packaging
Sealcraft
Universal Air

LABORATORY

1, Chemicals
2, Equipment
3, Ovens
Aldert 2
Atlas Electric 2
J.B. Atlas 2, 3
BBC 3
BDH 1, 2
Bowers 2
C.W. Brabender 2, 3
Brookhaven 2
Caframo 2
Can-Eng 3
Can-Quip 2
Can-Am 2
Cancopex 2, 3
R.P. Cargille 2
Cascade 2, 3
Cedco 2, 3
Charles Ross 2
CB Mills 2
Custom Scientific 2
Draiswerke 2
Dry Clime 2, 3
Fred A. Dungey 2
Edwards 2
Eiger Mach. 2
Emcho Supply 2
Epworth 2
Fab. Plastics 2
Firing 2
Folio Inst. 2, 3
Fostoria 3
Fryson 2
Geneq 2, 3
Grey Lightnin 2
Hadley Tekscience 2
John Herning 3
Hockmeyer 2
Horizon 2, 3
Huntington Labs. 1
Jaygo 2
Kinetic Disp. 2
Lab-Line 2, 3
LaMotte 2
Leneta Co. 2
Lepel 2
L.V. Lomas 2
Marathon 3, 3
Markland 2
Metal Samples 2
Micco Dist. 2
Millipore 2
Nettsch 2
Osmonics 2
Park Thermal 2, 3
Patterson Ind. 2
Paul N. Gardner 3
Pcu Kern 2
Plasmag Pump 2
Premier Mill 2
Prism 2
Prism Powder 2, 3
QC Inst. 2
Q-Panel 2
Rheometrics 2
Sensorex 2
Shadrock 2
Sigma 2
Spectra-Tech 2
Teledyne Spec. 2
Testing Machines 2, 3
Trell Services 3
Union Process 2
Vorti-Siv 2

LABORATORY TESTING SERVICES

R.P. Cargille
Nettsch

LIQUID LEVEL INSTRUMENTS

Baker Inst.
Can-Am
Cancoppas
Cedco
Geneq
Higginson
Honeywell
Horizon
Novapro
Onior
Peacock
Poly Prod.
Process Tech.
QC Inst.
Rousseau Controls
Uehling
Wallace & Tieman
Westinghouse
York Fluid

M

MATERIALS HANDLING EQUIPMENT

Alcore Fabricating
Allied Conveyors
C.M. Ambrose
Automated Systems
Bowers
Buhler
Can-Eng
Chisholm Mach.
Delta Equip.
Durr
Eisenmann
Elwell-Parker
Finnig
Fred Cressman
John T. Hepburn
Higginson
Hoover Group
Kinetic Disp.
Lion Shipping
Masdom
Mathews Conveyor
Moody SI
Pacline Overhead
Peacock
Prism Powder
Semi-Bulk
Shadrack
Spelmec
Steffab Niagara
Tri Lite
Vac-U-Max
Vorti-Siv
Wallace & Tieman
Westglen
Wilkie Bros.
Williams & Wilson
York Belting

METERS

Analytical Meas.
Badger Meter
Baker Inst.
John Brooks
Cdn. Meter
Cancoppas
Cedco
Delta Equip.
Flux Pumps
Geneq
Horizon
Liquid Controls
Markland
Maxon
Norspec
Onior

Osmonics
Schlumberger
Simpson Electric
Westinghouse
York Fluid

MIXERS/SHAKERS PAINT

Bowers
Buhler
Caframo
Cascade
Charles Ross
Delta Equip.
Draiswerke
Epworth
Fleming Gray
Fluid Mgmt.
Geneq
Horizon
Kinetic Disp.
Kirk Equip.
Lab-Line



Micco Dist.
Mixmor
Morse
Norspec
Paul N. Gardner
Peacock
Prism

Prism Powder
Ragogna
Sonic Corp.
Teledyne Spec.

MILLS

1, Air Classifying
2, Attrition
3, Ball
4, Colloid
5, Disc
6, Grinding
7, Pebble
8, Portable
9, Pot Laboratory
10, Roll
11, Sand
12, Small Media
C.W. Brabender 10
Buhler 3, 6, 10, 11, 12
Can-Quip 3, 4, 5, 7, 10, 11, 12
Cascade 3, 6, 7, 11
Cedco 3, 6, 11
Charles Ross 6, 10, 11
CB Mills 5, 6, 11, 12
Deane & Co. 5, 6, 11
Draiswerke 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Eiger Mach. 6, 11
Emchem Sales 4, 5, 11
Epworth 2, 3, 5, 6, 7, 8, 9, 11, 12
Finnig 1, 2, 3, 6, 10
Folio Inst. 9, 12
Fryma 3, 6
H.B. Fuller 3, 7
Geneq 3, 5, 6, 7, 10
Hockmeyer 6, 12
Horizon 4, 5, 6, 7, 8, 9, 11, 12

Hosokawa 6, 9
Jaygo 3, 5
Kinetic Disp. 2, 3, 4, 5, 6, 7, 9, 11, 12



L.V. Lomas
Limited/Limtee

L.V. Lomas 3, 5, 6, 11, 12



DISTRIBUTORS INC.

Micco Dist. 4, 5, 6, 8, 12
Nettsch 3, 5, 6, 7, 9, 10, 11
Patterson Ind. 3, 6, 7
Paul O. Abbe 3, 6, 7
Paul N. Gardner 7
Premier Mill 2, 4, 5, 6, 7, 8, 11, 12
Ragogna 11
Shadrack 3, 4, 6
Sigma 3, 4, 6, 11
Sonic Corp. 4
Taylor Sules 2, 6
Union Process 2, 3, 6, 7, 9, 12

O

OPTICAL MEASUREMENT EQUIPMENT

R.P. Cargille
Cascade
Cedco
Control Solutions
Folio Inst.
Frank J. Cox
Hadley Tekscience
Heraeus DSET
Macbeth
Norspec
Zorelco

P

PAINT CONTAINERS, Metal

Bowers
Cascade
Crown Cork
Henley
Hoover Group
Horizon
Ind. Containers



L.V. Lomas
Limited/Limtee

L.V. Lomas
Milton Can
Nampac
Norspec
Steffab Niagara
Stochem

PAINT CONTAINERS, Plastic

Crown Cork
Henley
Hoover Group
Horizon
Ind. Containers
LMG Reliance
Nampac

PALLETIZERS

C.M. Ambrose
Chisholm Mach.
Eckert
Mathews Conveyor
Micco Dist.
New London
Shadrack
Unisource

POWDER COATING

1. Cooling Belts
2. Compounds
3. Extruders, lab
4. Extruders, Single Screw
5. Extruders, Twin Screw
6. Feeders
7. Grinding, Mills
8. Mixers & Blenders
9. Sifters & Screeners
Bowers 8,9
C.W. Brabender 2,3,4,5,7,8
Buss America 1,2,3,4,6,7,8
Caframo 8
Cedco 8,9
Flux Pumps 8
Horizon 8
Marathon 1
Micco Dist. 7,8
Paul O. Abbe 7,8
Paul Mueller 8
Prism 1,2,3,5,6,8
Prism Powder 1,2,3,5,6,8
Teledyne Spec. 1,3,5,8

PRESSURE VESSELS

Bowers

Charles Ross
CB Mills
Delta Equip.
Emchem Sales
Graco
ISP
Kinetic Disp.
Micco Dist.
Panteron Ind.
Paul Mueller

PULVERIZERS

Buhler
Buss America
Can-Quip
Fining
Geneq
Shadrack

PUMPS

1. Air powered
2. Centrifugal
3. Diaphragm
4. Drum
5. General
6. Hand
7. High vacuum
8. Positive displacement rotary
9. Proportional
Aimark Travers 1,3,8
Automated Systems 1,2,3
Binks 5
B.J.M. 2,5
Blackmer 4,5,6,7,8

Bolair 9
John Brooks 1,2,5,6,8,9
Can-Am 8
Cancopas 2,3,4,7,8
Compair 1
CVC 7
Dayton Rogers 1,5,9
Delta Equip. 1,2,5,8,9
Deming Pump 5
Fred A. Dungey 1,5,9
Edwards 7
Fab. Plastics 2,4,8
Finish Thompson 2,4
Flux Pumps 1,2,4,8
H.B. Fuller 1
Geneq 2,7
Gen. Fabrications 1,2,3
Gorman-Rupp 5,8
Graco 1,2,5,6,8,9
Graymills 1,2,5
Greely Lightnin 9
Grover 1
Hayward Gordon 1,2,5,6,8,9
Horizon 3,4,5,6
Ind. Filter 2
Ingersoll-Dresser 2,3,5,8
Ingersoll-Rand 1,2,5
ITT Fluid 1,2,5,6
Kirk Equip. 2,5,9
Kremlin 1,3,4,9
LCI Corp. 8
Lion Shipping 6
L.V. Lomas 1
Malcolm Campbell 1,2,3,4,5,6,8
Millar-Williams 2,5,9
Morse 6
Netzsch 4,5,8,9
Norspec 8
Novapro 1,1,3,4,5,5,6,6,8,9
Onton 2,5
Osmonics 2,3,5
Paintronic 1
PAP Engr. 1,7,8
Paul N. Gardner 6
Peacock 8
Plasmag Pump 2
Polyquip 2,5
Ragogna 1,8
Robbins & Myers 8,9
Rousseau Controls 1,5,6,7,8,9
Sigma 1
Thompson-Chemtrex 1,2,5
Tri-Canada 2
Vac-U-Max 8
Viking Pump 1,2,5,6,8
Wainbee 7
Warren Rupp 1,3,4,5
Westglen 1,3
Wilden Pump 1,5
Wilkenson 8
Windsor Pump 1,2,3,4,5,6,7,8,9

PYREX GLASS ITEMS

Cedco
Geneq

PYROMETERS

Baker Inst.
Cedco
Hamilton Thermal
K.H. Huppert
Norspec
Paul N. Gardner
Pyrometer
Simpson Electric
Testing Machines

R

RECORDERS

Airflow
Analytical Meas.
Automated Systems
Badger Meter
Baker Inst.
Cedco
Delta Equip.
Drake Water
Eclipse
Geneq
Gen. Fabrications
Hadley Tekscience
Hamilton Thermal
Honeywell
Palmer
Powers Process
QC Inst.
Simpson Electric
H.O. Trence
United Electric
Westinghouse

RECORDING CHARTS

Airflow
Automated Systems
Bacharach
Baker Inst.
Cedco
Delta Equip.
Eclipse
Geneq
Honeywell
KTA-Tator
Palmer
Park Thermal
Powers Process
QC Inst.
Simpson Electric
H.O. Trence
United Electric
Westinghouse

RECORDING THERMOMETERS

Airflow
Automated Systems
Bacharach
Baker Inst.
Cedco
Eclipse
Geneq
Hamilton Thermal
Honeywell
KTA-Tator
Palmer
Paul N. Gardner
ProQuip Cons.
QC Inst.
Testing Machines
H.O. Trence
United Electric
Westinghouse
Zorelco

REFLECTOMETERS

J.B. Atlas
Cascade
Cedco
Geneq
Paul N. Gardner
Testing Machines

REGULATORS

Air Products
Automated Systems
Baker Inst.
Binks

Bolair
John Brooks
Burling Inst.
Cdn. Meter
Cedco
Compair
Delta Equip.
Eclipse
Graco
Malcolm Campbell
Masdon
Maxitrol
Norspec
Novapro
Osmonics
Powers Process
Rousseau Controls
Treil Services
H.O. Trence
Watts Regulator
Westinghouse
Williams & Wilson

S

SAND, Grinders

Can-Quip
Cascade
CB Mills
CB Mills
Deane & Co.
Draiswerke
Eiger Mach.
Emchem Sales
Epworth
Geneq
Horizon
L.V. Lomas
Netzsch
Westglen

SAND, Grinding Media

CB Mills
Deane & Co.
Draiswerke
Eiger Mach.
Emchem Sales
Epworth
Horizon
Kinetic Disp.
L.V. Lomas
Netzsch
Quackenbush

SCREENERS

Bowers
Shadrack
Vorti-Siv

SCRUBBERS AIR & GAS

Automated Systems
Fab. Plastics
H.B. Fuller
Geneq
Hamilton Thermal
Hosokawa
McCarthy Robinson
Metcalf & Eddy
Norspec
PAP Engr.
Shadrack
W.W. Sly

SIEVES

Bowers
Emchem Sales
Geneq
Hosokawa
Paintronic

Paul N. Gardner
Vorti-Siv

SOLVENT RECOVERY EQUIPMENT

Adwest
Air Products
Bowers
Caframo
Cascade
Cedco
CB Mills
Durr
Emchem Sales
Fryson
Horizon
LCI Corp.
L.V. Lomas
Malcolm Campbell
McCarthy Robinson



Mico Dist.
Omega Recycling
PAP Engr.
Patterson Ind.
Progressive Recovery
Reeco
Vac-U-Max
York Fluid

SOLVENT RECOVERY SERVICES

Adwest
Alchem
Comet
Reeco

SPECTRO REFLECTOMETERS

J.B. Atlas
Cascade
Cedco
Chisholm Mach.
Datacolor
Horizon

SPECTRO PHOTOMETERS

J.B. Atlas
Cedco
Datacolor
Folio
Fryson
Geneq
Hadley Tekscience
Horizon
Macbeth
Minolta
X-Rite

STRAINERS

R.P. Adams
Blackmer
Bowers
John Brooks
Cdn. Meter
Delta Equip.
Dry-Con
Emchem Sales
Fab. Plastics
Geneq

Horizon
Ingensol-Rand
ISP
Jaygo
Kirk
Lomas
Millar-Williams
Newark Wire
Norspec
Novapro
Onitor
Paul N. Gardner
Peacock
Rousseau Controls
Tri-Canada
Vorti-Siv
Westgen
Wilkerson
Williams & Wilson
York Fluid

T

TANK HEATERS

Automated Systems
Bowers
Chem. Equip. Fab.
Dry-Con
Eclipse
Gasmac
Gen. Fabrications
Hamilton Thermal
ITT Fluid
Millar-Williams
Park Thermal
Patterson Ind.
Process Tech.

TANKS STORAGE

Alcore Fabricating
Automated Systems
Bowers
Canada Colors
Can-Am
Canbar
Charles Ross
Chem. Equip. Fab.
CB Mills
Clawson Tank
Clemmer
Delta Equip.
Epworth
Fab. Plastics
Fred Cressman
Gen. Fabrications
Giffin Contractors
John T. Hepburn
Hoover Group
Jaygo
Kenta Prod.
Kinetic Disp.
L.V. Lomas
Patterson Ind.
Paul Mueller
Peacock
Progressive Recovery
Stellfab Niagara
Westgen

TANKS, Thinning and tinting

Bowers
Can-Quip
Canada Colors
Charles Ross
CB Mills

Clemmer
Emchem Sales
Epworth
Hockmeyer
Horizon
Jaygo
Kinetic Disp.
L.V. Lomas
Mico Dist.
Patterson Ind.
Paul Mueller
Ragogna
Westgen

TEST EQUIPMENT

1, Abrasion
2, Adhesion
3, Film Thickness
4, Gloss
5, Hardness
6, Metal Panels
7, Opacity
8, UV Resistance
9, Wood Panels
10, Weathering
ACT Labs 6
Advanced Coating 6
Atlas Electric 2
J.B. Atlas 1, 2, 4, 9
Cascade 1, 2, 3, 4, 5, 6, 7, 8, 9
Cedco 1, 10, 2, 3, 4, 5, 5, 7, 8
Chemroy 10, 2, 6, 7, 8
CMI 3
DeFelsko 3
Elcometer 2, 3, 4
Elektro-Physik 3
Fischer Tech. 3, 5
Folio 1, 2, 3, 4, 5, 7
Frank J. Cox 3, 5
Geneq 1, 2, 3, 4, 5, 6, 7
Hadley Tekscience 1, 10, 2, 3, 4, 5
Heraeus DSET 10, 8
John Herring 1, 2, 3, 4, 5
Horizon 1, 10, 2, 3, 4, 5, 6, 7, 8, 9
KTA-Tator 2, 3, 4, 6
Leneta Co. 6, 7, 9
Macbeth 4
Malcolm Campbell 3
Metal Samples 6
Minolta 4, 7
Norspec 3
Novapro 3, 4
Park Thermal 5
Paul N. Gardner 1, 2, 3, 4, 5, 6, 9
QC Inst. 2, 3, 4, 5
Q-Panel 10, 2, 6, 8
Rheometrics 2
Semico 2
Solomat Inst. 2, 3, 6
Spraymat 6
Sub Tropical 10, 8
Testing Machines 1, 2, 3, 4, 5, 6
UPA Technology 3
Zorelco 1, 2, 3, 4, 5

THERMOMETERS INDICATING & RECORDING

Airflow
Bacharach
Baker Inst.
Cedco
Delta Equip.
Eclipse
Geneq
Hamilton Thermal
Higginson
Honeywell
Horizon
KTA-Tator
3M Canada
Norspec

Palmer
Park Thermal
Paul N. Gardner
Powers Process
Pyrometer
QC Inst.
Simpson Electric
Testing Machines
H.O. Trence
United Electric
Westglen
Zorelco

TURBIDIMETERS

Can-Am
R.P. Cargille
Cedco
Fryston
Geneq
Hadley Tekscience
LaMotte
Markland
Norspec

V

VALVES

1. Air
2. Control
3. General
Automated Systems 1, 2, 3
Badger Meter 2
Baker Inst. 2
Burkert/Richards 3
Cdn. Meter 1, 2
Compair 1, 2
Delta Equip. 1, 2, 3
Eclipse 1, 2, 3
Emcho Supply 3
Graco 1
Hamilton Thermal 1, 2, 3
Higginson 1, 2, 3
Honeywell 2
Ingersoll-Rand 1, 2
Jordan Valve 2
Malcolm Campbell 1, 3
Masdon 1, 3
Maxon 2
Millar-Williams 3
Novapro 1, 1, 2, 3
Onitor 1, 3
Osmonics 2, 3
Paasche Airbrush 1, 2
Powers Process 2
Rousseau Controls 1, 2, 3
H.O. Trence 1, 2

VARNISH, Kettles and trucks

Bowers
Charles Ross
Kinetic Disp.
L.V. Lomas
Patterson Ind.
Westglen

VIBRATING SCREENS

Bowers
Dry-Con
Eckert
Emchem Sales
L.V. Lomas
Newark Wire
Vortu-Siv
Westglen
York Fluid

VISCOMETERS

Bohlin
Can-Eng
Can-Am
Cascade
Cedco
Emchem Sales
Folio Inst.
Geneq
Horizon
Novapro
QC Inst.
Rheometrics
Testing Machines
Zorelco

VISCOSITY CONTROL EQUIPMENT

Bohlin
C.W. Brabender
Can-Am
Cascade
Cedco
Deane & Co.
Graymills
Malcolm Campbell
QC Inst.
Zorelco

W

WATER DEMINERALIZERS

Aumark Travers
Atlas Electric
J.B. Atlas
Dow Chemical
Dukes
Gen. Fabrications
Horizon
Ind. Filter
Magnus
Millipore
Norspec
Osmonics
Van Waters

WASTE HANDLING EQUIPMENT

Chem-King
Dukes
Eckert
Fin. Engr. Serv.
Teledyne Spec.
Vac-U-Max
York Fluid

WASTE WATER SAMPLERS

Markland

WASTE WATER TREATMENT SYSTEMS

ACG Technology
Aumark Travers
Air Products
Automated Systems
Dukes
Eisenmann
Fryston
Geneq
Gen. Fabrications
Giffin Contractors
Haas Corp.
Haviland Engr.
Ind. Filter
Inmat

LCI Corp.
L.V. Lomas
Malcolm Campbell
Manchester
Millipore
R.F. Mote
Norspec
Osmonics
Patterson Ind.
Poly Prod.
Sensorex
Shadtrack
Star Systems
York Fluid

APPENDIX E2

EQUIPMENT MANUFACTURERS

BY NAMES AND ADDRESSES

(EXCERPTS FROM COATINGS MAGAZINE

JANUARY/FEBRUARY 1994)

1994 BUYER'S GUIDE

MANUFACTURERS AND DISTRIBUTORS, COAST TO COAST

A

AAF Div. Snyder General Canada 6969 Trans Canada Hwy #142, St. Laurent, PQ, H4T 1V8. 514-956-1144. 514-956-9076. Branch/Distributors: AAF/Snyder General: Delta, BC; Brampton, ON; Winnipeg, MB; Quebec, QC; B.G.E. Service & Supply, Edmonton, Calgary, AB & Saskatoon, Regina, SK Walmar Agencies, Ottawa, ON; Kemo Products, Thunder Bay, ON; Moncton, NB; Halifax, NS; Boucherville, QC; Prince George, BC; Montreal, QC; Systems Supply Northern, Sudbury, Sault Ste. Marie, North Bay, ON; BGE Service & Supply, Edmonton, AB; Calgary, AB; Saskatoon, SK; Air Systems Supplies, Vancouver, BC; M & M Engineering, Halifax, NS Systems Supply Northern, Sudbury, ON;

ABB Air Preheater Andover Road, Wellsville, NY, 14895. 716-593-2700. 716-593-2721.

ABB Paint Finishing 1400 Stephenson Hwy., Troy, MI USA, 48083. 313-588-0062. 313-588-3677.

Abbott Labs. 1400 Sheridan Rd North., Chicago, IL USA, 60064. 312-937-5180. Branch/Distributors: Chemroy Chemicals Ltd., Mississauga, ON Chemroy Chemicals Ltd., Montreal, PQ

Abrex Inc. 280 Wycroft Rd., Oakville, ON, L6K 2G7. 905-845-9191. 416-845-6619.

ACG Technology 2295 Dunwin Drive #7-8, Mississauga, ON, L5L 3S4. 905-828-7450. 905-828-2918.

ACS Environmental 303 Silver Spring Road, Conroe, TX, 77303. 409-856-4515. 409-856-4589.

ACT Laboratories Inc., 273 Industrial Dr., Hillsdale, MI USA, 49242. 810-827-3333. 810-827-3338. Branch/Distributors: Distribution 88, Montreal, PQ; Hamilton Sales, Bedford, NS;

Adamin Industries Ltd. 103 Baillargeon, Chateaugay, PQ, J6J 4Z2. 514-692-8255.

R. P. Adams 352 East Park Dr., Buffalo NY, 14240. 716-877-2608. Branch/

Distributors: Williams and Wilson Ltd P.O. Box 6117, Montreal, PQ E. P. Davidson & Co. Ltd., Vancouver, BC and Toronto, Ottawa, Windsor

ADM-Agri Industries Ltd. 5550 Maplewood Drive., Windsor ON, N9C 3Z1. 519-972-2354.

Advanced Coating 26911 Northwestern Hwy., Southfield, MI USA, 48034. 313-528-3319. 313-262-1598.

Advanced Curing 3701 S. Ashland Avenue., Chicago IL, 60609. 312-247-3600. Branch/Distributors: ProQuip Consultants, North York, ON

Adwest Technologies Inc. 803 West Angus Avenue, Orange, CA USA, 92668. 714-997-8722. 714-997-8744.

Affiliated Engineering 3401 McNicoll Avenue #11, Scarborough, ON, M1V 4B7. 416-299-8989. Branch/Distributors: Ville St. Laurent, PQ;

Almark Travers 300 Steelcase Road W #23, Markham ON, L3R 2W2. 416-475-3660. 416-495-0005. Branch/Distributors: Montreal, PQ

Air Filter Sales 101 Courtland Avenue, Concord, ON, L4K 3T5. 416-669-5470. 416-669-5463.

Air Products Canada Ltd. 2090 Steeles Avenue E., Brampton ON, L6T 1A7. 905-791-2530. 905-791-6808. Branch/Distributors: Nepean, ON; Richmond, BC; Calgary, AB; Prodair, Lasalle, PQ; Quebec, PQ;

Airflow Developments 150 Armstrong Ave. Unit 8, Georgetown, ON, L7G 5G8. 905-873-7333. 905-873-7779.

Alko Chemicals 1 Livingstone Avenue, Dobbs Ferry, NY, 10522. 914-693-1200. 914-693-7854. Branch/Distributors: Industrial Colors & Chemicals, Brampton, ON; Henley Chemicals Ltd., Scarborough, ON; Vaudreuil, PQ

Alko Chemicals 500 Jersey Avenue., New Brunswick NJ, 08903. 201-247-2202. Branch/Distributors: Industrial Colors & Chemicals, Brampton, ON; Henley Chemicals Ltd., Scarborough, ON; Vaudreuil, PQ

Alberta Linseed Box 518., Medicine Hat AB, T1A 7G5. 403-527-1147. Branch/Distributors: Outram Chemical Co. Ltd., Port Moody, BC L.V. Lomas Chemical Co. Ltd. Mississauga, ON

Albright & Wilson 2 Gibbs Rd., Toronto ON, M9B 1R1. 416-239-7111.

Alcan Toyo 1717 North Naper Blvd., Naperville, IL, 60563. 312-644-6100. 312-644-6514. Branch/Distributors: Chemroy Canada Inc., Toronto, Montreal.

Alchem 1055 Truman St./Box 5002., Burlington ON, L7R 3Y9. 416-632-8791. Branch/Distributors: Edmonton, AB;

Akore Fabricating Corporation 65 Newkirk Road., Richmond Hill ON, L4C 3G4. 416-770-6565. 416-737-1296.

Aldert Chemicals Ltd. 4889A Dundas St. W. Ste. 4, Islington, ON, M9A 1B2. 416-236-4222. 416-236-4216.

Alfa-Laval 101 Milner Avenue., Scarborough ON, M1S 4S6. 416-299-6101. Branch/Distributors: Vancouver, BC;

Alcolour Paint & Chemicals 1257 Speers Rd., Oakville ON, L6L 2X5. 416-827-4173. 416-827-6487. Branch/Distributors: Alcolour-Holloway Paints Ltd., Edmonton, AB;

Allied Colloids Canada Inc. 11 Automatic Road, Brampton, ON, L6S 4K6. 905-793-9473. 905-793-9537. Branch/Distributors: Canada Colours for West of Ontario;

Allied Conveyors Limited 902 Dillingham Rd., Pickering, ON, L1W 1Z6. 905-283-5109. 905-283-3776.

Allied-Kelite 2701 Lake Street, Melrose Park, IL, 60160. 708-450-7435. Branch/Distributors: Cromatic Chemical Company, Brampton, ON;

AlliedSignal Inc. P.O. Box 1039, Morristown, NJ USA, 079621039. 201-455-5571. 201-455-6154. Branch/Distributors: Canada Colors and Chemicals Ltd.

Almeo 902 East Main Street., Albert Lea MN, 56007. 507-377-2102. Branch/Distributors: Orlick Industries, Hamilton.

Alt-Chem International Inc. RR2 Fields Lane, North Salem, NY, 10560.
914-277-1808. 914-277-1810.

C.M. Ambrose 20325 71st Ave. NE #D., Arlington, WA, 98223. 206-435-1141.
206-435-8200.

AmeriChem Engineering 3430 East Broadway, Phoenix, AZ, 85040.
602-437-1188.

Amerchol 136 Talmadge Road/CN4051, Edison NJ USA, 088184051.

201-287-1600. Branch/Distributors:
Charles Tennant & Co. Canada Ltd.,
Weston, Ontario; Dorval, Quebec.

Amerdec 90 Le Baron, Waukegan, IL,
60085. 708-623-6650.

Amoco Chemical Company 200 E.
Randolph Dr. MC410, Chicago IL USA,
60601 7125. 312-856-4729. Branch/
Distributors: Stanchum Ltd.

Anachemia Ltd. 135 Richer, Ville St.
Pierre, PQ. H8R 1R4. 514-481-8010.
514-481-6340.

Anachemia Solvents Div. Fielding Chem.
3549 Mavis Road., Mississauga ON, L5C
1T7. 905-279-5122. 905-279-4130.

Analytical Measurements of Canada
Ltd. 2428 Islington Ave #14., Etobicoke,
ON, M9W 3X8. 416-749-7179.
416-749-8289.

Angus Chemical Company 1500 E. Lake
Cook Road, Buffalo Grove, IL USA,
60089. 708-215-8600. 708-215-8626.
Branch/Distributors: Van Waters & Rogers,
Weston, ON; Canada Colors, Don Mills,
ON;

Apco 10 Industrial Street., Toronto ON,
M4G 1Z1. 416-421-6161. Branch/
Distributors: Br. 1253 McGill College Ave.,
Montreal, PQ Tel: 514-866-6082

Appearance Technologies, 112 North
Main Street., Ann Arbor, MI.,
313-662-7388.

Aqualon Canada Inc. 2 Robert Speck
Pkwy., Mississauga, ON, L4Z 1H8.
905-848-1800. 905-848-8507. Branch/
Distributors: Montreal, PQ; Chemroy
Canada, Richmond, BC

Aquarius Coatings Inc. 7-30 Royal Crest
Court, Markham, ON, L3R 9W8.
416-940-0860. 416-940-0874. Branch/
Distributors: Aquarius Coatings, Bedford,
NS; Armafont Paints, Fabreville, Laval,
Que.; Polyfilm Products, Montreal, PQ;
Carl Guilmette, Ottawa, ON; Tetra
Coatings, Guelph, ON; Construction
Specialty, New Westminster, BC; Cal-Ell
Sales, West Vancouver, BC;

Arco Chemical Canada 100 Consilium
Pl #306., Scarborough ON, M1H 3E3.
416-296-9864. 416-296-9834.

Ardrox Ltd. 17 Woodburn Avenue, St.
Catharines, ON, L2R 6Y3. 905-688-1085.
905-684-4214.

Arrow Pneumatics 500 N. Oakwood
Road., Lake Zurich IL, 60047. Branch/
Distributors: Nopak Canada Ltd., Waterloo,
ON; Higginson Equip. Sales, Burlington,
ON; FAE Sales & Service Ltd., Vancouver,

BC; Associated Instrumentation &
Controls, Montreal, PQ

Ashland Chemical 2620 Royal Windsor
Drive., Mississauga ON, L5J 4E7.
416-823-1800. Branch/Distributors:
Montreal PQ; Vancouver, BC

Asoma Instruments Inc. 11675 Jollyville
Road, Austin, TX, 78759. 512-258-6608.

Atlantic International Equip. Sls. 221 N.
Rivermede Rd. #5, Concord, ON, L4K
3N7. 416-738-5489. 416-738-6751.
Branch/Distributors: Most major cities
across Canada.

Atlas Electrical 4114 N Ravenswood
Avenue., Chicago IL, 60613.
312-327-4520. Branch/Distributors: J.B.
Atlas Co., Rexdale, ON

J B Atlas 9 Canso Road., Rexdale ON,
M9W 4L9. 416-247-8791.

Atlas Minerals & Chemicals Inc.
Farmington Road., Mertztown PA USA,
19539. 215-682-7171. 215-682-9200.
Branch/Distributors: H.L. Blachford Ltd.,
Mississauga, ON

Automated Jetting 150 Britannia Road
East, Mississauga, ON, L4Z 2A4.
416-507-8484. 416-507-8486.

Automation Products 3030 Max Roy
Street., Houston TX, 77008. 713-869-0361.
713-869-7332.

Automated Systems Integrators Inc.
17524 S. Carriageway Dr., Hazelcrest, IL
USA, 60429. 708-798-7788.
708-798-7818.

B

Bacharach Inc. 625 Alpha Drive.,
Pittsburgh PA USA, 15238. 412-963-2000.
412-963-2640. Branch/Distributors:

Canadian General Filters, Scarborough,
ON; Bantle & Gibson, Edmonton, AB;
Refac, St. Leonard, PQ;

Badger Meter 4545 West Brown Deer
Road, Milwaukee WI, 53223.

414-355-0400. Branch/Distributors:
Roquip Industrial Sales, Montreal, PQ;
Thomas W. Mackay & Sons Ltd.,
Vancouver, BC; Aquacare Services Ltd.,
Huntsville, ON; J & M Industrial Supply
Ltd., Downsview, ON; Fluid Transfer
Rothesay, NB

Baker Instruments Limited Unit #1/349
Bowes Road., Concord ON, L4K 1J3.
416-738-4780. 416-738-4785.

BASF Canada 345 Carlingview Drive.,
Toronto, ON, M9W 6N9. 416-675-3611.
416-674-2588. Branch/Distributors:
Montreal, Province De Quebec; Vancouver,
British Columbia;

BBC Industries, 1526 Fenpark Drive.,
Fenton MO, 63026. 314-343-5600. Branch/
Distributors: Marathon Ind. Prod., Whitby,
ON;

BDH Inc. 350 Evans Avenue., Toronto ON,
M8Z 1K5. 416-255-2264. 416-255-7453.
Branch/Distributors: Vancouver, BC; Ville
St. Laurent, PQ;

Belanger Inc. 1001 Doherty Circle,
Northville MI, 48167. 313-349-7010.
313-349-3268.

Belco Industries Inc. 115 E. Main,
Belding, MI, 48809. 616-794-0410.
616-794-3424.

Bete Fog Nozzle 50 Greenfield Street,
Greenfield MA, 01301. 413-772-0846.
Branch/Distributors: Industrial Mechanical
Spec., Thornhill, ON

Betz Inc. 3026 Soland Road, Kanata, ON,
K2K 2A5. 613-592-5050. 613-592-0909.

Bex Engineering 5115 Timberlea Blvd.,
Mississauga ON, L4W 2S3. 416-238-8920.
416-238-8955.

**B.F. Goodrich Co. Specialty Polymers
& Chemicals** 9911 Brecksville Road,
Cleveland, OH USA, 44141.
216-447-5000. 216-447-5770.

Binks Manufacturing 14 Vansco Road.,
Toronto ON, M8Z 5J5. 416-252-5181.
Branch/Distributors: Montreal, PQ;
Vancouver, BC; London, ON; Winnipeg,
MB; Armdale, NS

Biobal Equipment 505 Iroquois Shore Rd
#14, Oakville, ON, L6H 2R3.
416-844-2062. Branch/Distributors:
Dorval, PQ;

Birkett/Richards 3170 Wason Road,
Cincinnati, OH USA, 45209.
800-354-0305.

B.J.M. Corp. 123 Spencer Plains Road,
Old Saybrook, CT, 06475. 203-399-5937.
203-399-7784.

Blachford Corporation Zeller Products
235 East Oak St., Coal City, IL USA,
60416. 815-634-4000. 815-634-3000.

H.L. Blachford Ltd. 2323 Royal Windsor
Drive., Mississauga ON, L5J 1K5.
905-823-3200. 905-823-9290. Branch/
Distributors: Montreal, PQ

Blackstone Ultrasonics 1111 Allen Street,
Jamestown NY, 14701. Branch/
Distributors: Electrodesign Ltd., Montreal,
PQ

Blackmer 1809 Century Ave SW., Grand
Rapids MI, 49509. 616-241-1611.
616-241-3752. Branch/Distributors:
Blackmer, Oro, ON, 616-241-3752.

Blasdel Enterprises 495 W. McKee St/P.O.
Box 260, Greensburg IN, 47240.
812-663-3213. 812-663-4968.

Blu-Surf Inc. 8550 East Michigan Ave.,
Parma MI, 49269. 517-531-3346.
517-531-3589.

Bohlin Instruments Inc. 2540 Route 130,
Cranbury NJ, 08512. 609-655-4447.
609-655-1475.

Bolair 1079 Britannia Road., Mississauga
ON, L4W 3X1. 905-564-2231.
905-564-2236.

Borden Chemical 595 Coronation Drive.,
West Hill ON, M1E 4R9. 416-281-6000.
Branch/Distributors: North Bay, ON;
Laval, PQ; Edmonton, AB; Vancouver, BC;
West Hill, ON

Bowers Process Equipment Inc. 487
Lorne Avenue East., Stratford ON, N5A
6T1. 519-271-4757. 519-271-1092.

C W Brabender 50 East Wesley Street., S Hackensack NJ USA, 07606.
201-343-8425. Branch/ Distributors: Spaltech International, Mississauga, ON;

Branson Ultrasonics 41 Eagle Road, Danbury, CT, 068131961. 203-796-0400. 203-796-9813. Branch/ Distributors: Markham, ON;

Brenco 324 Wyecroft Road., Oakville ON, L6K 2G7. 416-845-9888. Branch/ Distributors: Ray Yexxa Raydon Sales Ltd., Dartmouth, NS Plastic Royal Inc. Montreal
Brinkman Instruments 50 Galaxy Blvd. Unit #1, Rexdale, ON, M9W 4Y5. 416-675-7911.

Brockway Standard, 2235 Enterprise Dr. #60154, Westchester, IL USA, 60154. 708-409-1400. 708-409-1411.

Brookhaven Instruments Corporation 750 Blue Point Road, Holtsville, NY USA, 11742. 516-758-3200. 516-758-3255. Branch/ Distributors: ZM Associates Inc., Thornhill, ON;

John Brooks 1257 Kamato Road, Mississauga ON, L4W 1Y1. 416-624-5757. Branch/ Distributors: Montreal, PQ; Calgary, AB; Winnipeg, MB; Vancouver, BC; Edmonton, AB; London, ON.

Buckman Labs 351 Boul. Joseph Carrier, Vaudreuil, PQ, J7V 5V5. 514-424-4404. 514-424-4294.

Buffalo Color 207 Place Frontenac., Pointe Claire PQ, H9R 4Z7. 514-695-0560. Branch/ Distributors: Montreal, PQ

Buhler (Canada) Inc. 16 Esna Park Dr. Unit 8, Markham, ON, L3R 5X1. 905-940-6910. 905-940-3298.

Burgess Pigment P.O. Box 349., Sandersville GA, 31082. 912-552-2544. Branch/ Distributors: St. Lawrence Chemical, Baie D'Urfe, PQ; Rexdale, ON;

Burling Instruments Inc. Box 298/16 River Road., Chatham NJ USA, 07928. 201-635-9481. 201-635-9530.

Buss America 230 Covington Dr., Bloomingdale, IL, 60108. 708-307-9900.

Byk-Chemie 524 South Cherry Street., Wallingford Ct. 06492. 203-265-2086. Branch/ Distributors: Degussa Canada Ltd., Burlington, ON Horizon Chemicals Ltd., Richmond, BC

Byk-Gardner 2435 Linden Lane, Silver Spring, MD, 20910. 301-495-7150. 301-585-4067.

C

Cabot Corporation Special Blacks Div. 157 Concord Rd., Billerica, MA, 01821. 508-663-3455. Branch/ Distributors: Cabot Canada Ltd., Samia, ON.

Cabot Canada Ltd. PO Box 3020/350 Wilton St, Samia ON, N7T 7N4. 800-265-0265. 519-336-8501. Branch/ Distributors: Montreal, PQ;

Caframo Ltd. Box 70 Airport Road, Winton, ON, N0H 2T0. 519-534-1080. 519-534-1088.

Calefaction Systems Ltd. 33 Laird Dr., Toronto, ON, M4G 3S9. 416-696-2118. 416-425-4858.

Calfran P.O. Box 269, Springfield, MA, 01101. 413-525-4957. 413-525-1716.

Calgene Chemical Inc. 7247 N. Central Park Ave Skokie IL, 60076. 708-675-3950.

Calgon 27 Finley Road., Brampton ON, L6T 1B2. 416-457-5310. Branch/ Distributors: Edmonton, AB; Vancouver, BC; Quebec City, PQ; Moncton, NB Montreal, PQ; Fredericton, NB;

Camac 18 Commerce Road., Fairfield NJ, 07004. 201-575-1831. Branch/ Distributors: Kudzu Technologies Ltd., Markham, ON;

Can-Am Engineered Products Inc. 30850 Industrial Road., Livonia, MI USA, 48150. 313-427-2020. 313-427-4282.

Can-Eng Furnaces Ltd. 6800 Montrose Road., Niagara Falls ON, L2E 6V5. 905-356-1327. 905-356-1817.

Can-Quip P.O. Box 2026/Station B., Scarborough ON, M1N 2E5. 416-266-9688.

Canada Colors & Chemicals 80 Scarsdale Road, Don Mills ON, M3B 2R7. 416-449-7750. 416-449-1096. Branch/ Distributors: Toronto, ON; Montreal, PQ; Windsor, ON; Vancouver, BC; Calgary, AB; Edmonton, AB; Winnipeg, MB; Elmira, ON; Colbourne, ON;

Canada Square Resins 940 Lansdowne Avenue., Toronto ON, M6H 4G9. 416-531-6195. 416-531-1675. Branch/ Distributors: L. V. Lomas, Vancouver, BC;

Canada Talc Marmora Mine Road, Marmora, ON, K0K 2M0. 613-472-2434. Branch/ Distributors: Debro Chemicals, Rexdale, ON;

Can-Am 2495 Haines Road, Mississauga, ON, L4Y 1Y7. 416-277-0331. 416-277-2588.

Canbar P.O. Box 280/1 Canbar St., Waterloo ON, N2J 4A7. 519-886-2880. Branch/ Distributors: Bancroft Western Sales Ltd., North Vancouver, BC; Nortec SGS Inc., Montreal, PQ; Dartmouth, NS; Wawashkesh Sales Agencies, SW Calgary, AB

Canadian Industrial Conveyors 820 Nipissing Rd., Milton, ON, L9T 4Z9. 416-876-2707. 416-876-2707.

Canadian Meter Co. 3037 Derry Road West., Milton ON, L9T 2X6. 905-878-2361. 905-878-5758. Branch/ Distributors: Edmonton, AB; Chomedey, Laval, PQ.

Canadian NDE 18 Canso Road., Rexdale, ON, M9W 4L8. 416-243-3456. 416-243-1354.

Canadian Technical Tape 455 Cote Vertu., St. Laurent, PQ, H4N 1E8. 514-334-1510. 514-745-0764. Branch/ Distributors: Brampton, ON; Calgary, AB

Canbro Inc. 29 East Park Street., Valleyfield PQ, J6S 1P8. 514-373-0233. 514-373-4540.

Cancoppas Limited 1045 South Service Rd. W., Oakville ON, L6L 6K3. 416-847-2740. 416-827-6984. Branch/ Distributors: In all major cities across Canada.

Carborundum Abrasives North America 28 Albert Street., Plattsville ON, N0J 1S0. 519-684-7441.

Carborundum Co. 2351 Whirlpool St., Niagara Falls, NY USA, 14305. 716-278-6375. 716-278-2440. Branch/ Distributors: L. V. Lomas Ltd., Brampton, ON.

Cardinal Industrial Finishes 1329 Potrero Ave., S. El Monte, CA USA, 91733. 818-444-9274. 818-444-0382.

Cargill/Resin P.O. Box 5630., Minneapolis MN, 55440. 612-475-6478. Branch/ Distributors: Stochem Inc., Mississauga, ON; Lachine, PQ; Mackenzie & Feimann, Winnipeg, MB

R.P. Cargille Laboratories Inc. 55 Commerce Rd., Cedar Grove NJ, 07009. 201-239-6633. 201-239-6096.

Carroll Scientific Inc. 5401 S. Dansher Road, Countryside, IL, 60523127. 708-579-8000. 708-579-9477. Branch/ Distributors: Tartan Color & Chemicals, Mississauga, ON;

Carver Pump Co. 2415 Park Avenue/Box 389., Muscatine IA, 52761. 319-263-3410. 319-263-4565.

Cascade Marketing Ltd. #210 3540 W 41st Avenue., Vancouver BC, V6N 3E6..

Caspe 1028 Toy Avenue., Pickering ON, L1W 3P1. 416-686-2421. 416-686-1031.

Casso-Solar Corporation P.O. Box 163/US Route 202, Pomona NY USA, 10970. 914-354-2500. 914-362-1856. Branch/ Distributors: Proquip Consultants Inc., North York, ON

CDF Corp. 100 Enterprise Drive., Marshfield MA, 02050. 617-837-2823. 617-837-2823.

Cedco Instruments 751 Main St. E. Unit 9, Milton, ON, L9T 3Z3. 416-876-2847. 416-876-0227.

Celanese 195 The West Mall Ste 1000, Etobicoke, ON, M9C 5K1. 416-622-2032. Branch/ Distributors: L. V. Lomas Ltd., Van Waters & Rogers;

Cellite Canada Inc. 295 The West Mall., Etobicoke ON, M9C 4Z7. 416-626-8175. 416-626-8235. Branch/ Distributors: L. V. Lomas Ltd.; Van Waters & Rogers;

Cellite Corporation P.O. box 519., Lompoc CA USA, 93438. 303-978-4900. Branch/ Distributors: Cellite Corp., Etobicoke, ON;

Central New York Industries. Route 104 and Stock Rd., Hannibal, NY, 13074. 315-564-5112.

CFS Industrial Coatings 53 Judson St., Toronto, ON, M8Z 1A4. 416-252-7731. 416-252-8292. Branch/ Distributors: Montreal, PQ; Vancouver, BC;

Charles Ross 710 Old Willets Path., Hauppauge NY USA, 11788. 516-234-0500. Branch/ Distributors: Archem Process Equip., London, ON

Charles Tennant & Co. (Canada) Ltd. 34 Claydon Road., Weston ON, M9M 2G8. 416-741-9264. 416-741-6642. Branch/Distributors: Montreal, PQ; Vancouver, BC; Edmonton, AB;

Chemical Equipment Fabricators Ltd. 16 Estate Drive., Scarborough ON, M1H 2Z1. 416-438-9266. 416-438-0382.

Chemco Manufacturing Company Inc. 3175 MacArthur Blvd., Northbrook, IL USA. 60062. 708-480-7700. 708-480-7706. Branch/Distributors: Quebec Finishing Equip., Lachine, PQ; Dormer Finishing Systems, Winnipeg, MB; Spray Quip Ltd., Brampton, ON;

Chemfil Canada Ltd. 3258 Marentette Ave., Windsor, ON, N8X 4C4. 519-969-5570. 519-969-8512.

Chemgrate 19240-144th Ave NE., Woodinville WA, 98072. 206-483-9797. Branch/Distributors: Triple M Fiberglass, Edmonton, AB; Vorstad Products, Vancouver, BC.

Chemicolour 5565 Pare Street., Montreal PQ, H4P 1P7. 514-731-3945.

Chemjay Inc. 9680 St. Laurent, Montreal, PQ, H3L 2M9. 514-384-8440.

Chem-King Inc. R.R. #3, Barrie, ON, L4M 4S5. 705-737-1221. 705-721-8640. Branch/Distributors: King Technology, Barrie, ON

Chemor Inc. 236 St. Augustin St., Montreal PQ, H4C 2N6. 514-935-4665. 514-935-4870.

Chemroy Canada Inc. 2201 Drew Road., Mississauga ON, L5S 1E5. 905-677-0701. 905-677-8411. Branch/Distributors: Montreal, PQ; Vancouver, BC

Chemical Solvents Inc. 3751 Jennings Rd., Cleveland, OH, 44109. 216-741-9310. 216-741-4080.

CB Mills 1225 Busch Parkway., Buffalo Grove IL, 600894504. 312-459-0007.

Chisholm Machinery Box 245/5760 Valley Way., Niagara Falls ON, L2E 6T3. 416-356-1119. 416-356-9170.

Ciba-Gelby Canada Ltd. P.O. Box 2000, Mississauga ON, L5M 5N3. 905-821-4420. Branch/Distributors: Additives - Montreal; Clyde Chemicals Vancouver, BC

Cincinnati Industrial Machinery P.O. Box 62027, Cincinnati, OH USA, 45262. 513-769-0700. 513-769-0697.

Clawson Tank 4545 Clawson Tank Drive, Clarkson MI, 48347. 313-625-8700. Branch/Distributors: Canada Colors & Chemicals, Don Mills, ON; St. Laurent, PQ; Hamilton, ON; New Westminster, BC; Calgary, AB; Windsor, ON

Clemmer Box 130/446 Albert Street, Waterloo ON, N2J4A1. 19-884-4320. Branch/Distributors: Branch: Thunder Bay, ON; Calgary, AB;

Cleveland Process 127 S.W. 5th Ave., Homestead, FL, 33030. 305-248-4971.

Cloverdale Paint 6950 King George Highway., Surrey BC, V3W 4Z1. 604-596-6261. Branch/Distributors:

Surrey, Delta, Vancouver, Maple Ridge, Langley, White Rock, Victoria, Richmond, Colwood, Duncan, Nanaimo, Parksville, Quesnel, Kamloops, Vernon, Cranbrook, Calgary, Edmonton, Red Deer, Burnaby, Prince George, Abbotsford, Kelowna Port Coquitlam, Richmond, Campbell River, Sidney; Courtenay, Chilliwack, Haney, Penticton;

CMI International 2301 Arthur Ave., Elk Grove Village, IL, 60007. 800-678-1117. 708-439-4425.

Colloid Environmental 1500 West Shore Rd., Arlington Heights, IL, 60004. 418-392-5800. Branch/Distributors: World Environmental, London, ON;

Columbus Industries Inc. 2938 St. Rt. 752, Ashville, OH USA, 43103. 614-983-2552. 614-983-3147.

Color Corporation of America 1215 Nelson Blvd., Rockford, IL, 61104. 815-987-3777. 815-964-0559. Branch/Distributors: Microcolor Dispersions Ltd., Toronto ON Cascade Chemical, Vancouver, BC

Colorgen Canada Inc. 5805 Whittle Rd. Ste. 105, Mississauga, ON, L4Z 2J1. 416-507-2902.

Colt Chemicals 505 Consumers Road #810, Willowdale ON, M2J 4V8. 416-492-8606.

Columbian Chemicals 755 Parkdale Avenue North, Hamilton ON, L8H 7N5. 905-544-3343. Branch/Distributors: Emchem Sales Ltd., North Vancouver, BC; Edmonton, AB; Winnipeg, MB

Comet Chemical 400 Industrial Park R.R. 1, Thornton ON, L0L 2N0. 705-436-5580. 705-436-7194.

Compair Canada 871 Cranberry Court., Oakville, ON, L6L 6J7. 416-847-0688. Branch/Distributors: Montreal, PQ

John Comrie & Co. P.O. Box 247/Station O., Toronto ON, M4A 2N3. 416-757-4656.

Consolidated Coatings Corporation 7651 Vantage Way., Delta BC, V4G 1A6. 604-946-7626. 604-946-9609. Branch/Distributors: Dicker Martens, Victoria, BC; Delta, BC;

Control Mart 6805 Invader Cr. Unit 1., Mississauga, ON, L5T 2B7. 905-564-1777. 905-564-1855.

Conn and Company 11 S. Marion St., Warren, PA USA, 16365. 814-723-7980. 814-723-8502.

Control Solutions Inc. 2500 Williams Pkwy. #25, Brampton, ON, L6S 5M9. 905-458-8382. 905-791-3052.

Cook Composites P.O. Box 996, Port Washington, WI, 53074. 414-284-5541.

Cords Canada 62 Densley Avenue., Toronto ON, M6M 5E1. 416-242-6811. 416-242-6819.

Cornell Machine 45 Brown Avenue., Springfield NJ, 07081. 201-379-6860. 201-379-6854. Branch/Distributors: B & T Sales Limited, Scarborough, ON

Corrosion Service 369 Rimrock Road., Downsview ON, M3J 3G2. 416-630-2600. 416-630-9570. Branch/Distributors: Calgary, AB; Edmonton, AB; Samia, ON; Vancouver, BC; Boucherville, PQ; Dartmouth, NS;

Courtalds Aerospace Canada Inc. 266 Humberline Drive., Rexdale ON, M9W 5X1. 416-675-1911. Branch/Distributors: Kingsley and Keith (Canada) Ltd Montreal, PQ; Toronto, ON

Crane 175 Titus Ave., Warrington, PA, 18976. 215-343-6000. Branch/Distributors: Hayward Gordon Ltd., Mississauga, ON;

Crest Ultrasonics Scotch Road., Trenton NJ USA, 08628. 609-883-4000. Branch/Distributors: Stan Mech Agencies, Oakville, ON

Criterion Instruments 30 Progress Avenue., Scarborough ON, M1P 4W8. 416-299-6666. 416-299-8398. Branch/Distributors: Vancouver, BC; Montreal

CR Minerals Corporation 14142 Denver W. Pkwy #250, Golden, Colorado, 80401. 303-278-1706. 303-279-3772. Branch/Distributors: Frank E. Dempsey & Sons; Hahn Northwest Inc.

Crown Cork & Seal 105 Gordon Baker Rd., Willowdale ON, M2H 3P8. 416-756-5600.

Croda Canada Ltd. 78 Tisdale Avenue., Toronto ON, M4A 1Y7. 416-751-3571. 416-751-9611.

Cromac Chemical Company Limited 80 Summerlea Road, Brampton, ON, L6T 4X3. 905-458-1999. 905-458-7899. Branch/Distributors: Montreal, PQ

Crosfield Company 101 Ingalls Avenue., Joliet IL, 60435. 800-727-3651. Branch/Distributors: Canada Colors & Chemicals, Don Mills, ON

Cuno 400 Research Parkway., Menden CT, 06067. 203-237-5541. 203-238-8977. Branch/Distributors: Peacock Inc., Mississauga, ON; Peacock Inc., Montreal, Calgary, Toronto, Vancouver, Edmonton.

Custom Colour 130 Van Kirk Drive., Brampton ON, L7A 1B1. 416-846-0740. 416-840-2010.

Custom Fibers International 2045 Lebec Road #A, Lebec, CA, 93243. 805-248-9000. 805-248-1123. Branch/Distributors: Chemroy Chemicals, Mississauga, ON

Custom Scientific 13 Wing Drive., Cedar Knolls NJ, 07927. 201-538-8500. 201-984-6793. Branch/Distributors: J.B. Atlas Co., Rexdale, ON, 416-247-8791.

CVC Products 525 Lee Rd. P.O. Box 1886, Rochester NY USA, 14603. 716-458-2550. Branch/Distributors: St. Laurent, Quebec

Cytec Canada Inc. 88 McNabb Street., Markham ON, L3R 6E6. 905-470-3600. 905-470-3857. Branch/Distributors: Baie D'Urfe, Quebec; Scarborough, ON.

D

Max Daetwyler 13420 Reese Blvd. W.,
Huntersville, NC, 28078. 704-875-1200.
704-875-0781.

Dalcolor-Pope 40 Webro Road, Clifton, NJ
USA, 07012. 513-530-9608.

Daniel Products Company Inc. 400
Claremont Avenue., Jersey City NJ, 07304.
201-432-0800. 201-432-0266. Branch/
Distributors: L. V. Lomas, Toronto, ON;
L. V. Lomas, Montreal, PQ; Cascade
Marketing Ltd., Vancouver, BC

Datacolor International 5 Princess Road.,
Lawrenceville, NJ, 08648. 704-357-0400.
704-329-9925.

DataPac Inc. 187 Ballard Street,
Wilmington, MA USA, 01887.
508-988-9000. 508-988-0666. Branch/
Distributors: ProQuip Cons., North York,
Dayton Rogers 5925 Highway 7.,
Minneapolis MN, 55416. 612-925-2787.
612-925-6135.

Deane and Company 190 Oneida Drive.,
Pointe Claire PQ, H9R 1A8. 514-697-3730.
514-697-3887. Branch/Distributors:
Toronto, Winnipeg, Edmonton, Calgary,
Vancouver, Montreal, Quebec City,
Dartmouth, Ottawa, Moncton.

Debro Chemicals 6370 Kestrel Road.,
Mississauga ON, L5T 1Z3. 416-670-7800.
416-670-7813. Branch/Distributors:
Montreal, Vancouver, Calgary, Edmonton

Dedert Corp. 20000 Governors Drive.,
Olympia Fields, IL, 60461-1074.
708-747-7000. 708-755-8815.

DeFelsko Corporation 802 Proctor
Ave. PO Box 676, Ogdensburg, NY USA,
13669-0676. 315-393-4450. 315-393-8471.
Branch/Distributors: Corrosion Service,
Downsview, ON;

DeFelsko 1274 Ridgmont Ave., Ottawa
ON, K1V 6E5. 315-393-4450. Branch/
Distributors: Corrosion Service Co.,
Downsview, ON

Degraco 200 Sayre., Rockford IL, 61101.
815-987-3760. Branch/Distributors:
Inter-City Paints and Supply Ltd Toronto,

Degussa Canada Ltd. 4261 Mainway
Drive., Burlington ON, L7L 5N9.
905-336-3423. Branch/Distributors: Ville
St. Laurent, PQ Richmond (Vancouver),

Delmco P.O. Box 374., Marshalltown IA,
50158. 515-752-8806. Branch/
Distributors: ProQuip Consultants, North
York, ON

Delta Equipment 2400 Wyecroft Rd. Unit
4, Oakville ON, L6L 6M8. 416-827-9312.
Branch/Distributors: Quebec, Montreal,
Toronto, Winnipeg, Calgary, Vancouver

Delta International 644 Imperial
Road/POB 848, Guelph ON, N1H 6M7.
519-836-2840. Branch/Distributors:
Quebec, Montreal, Toronto, Winnipeg,
Calgary, Vancouver

Deming Pump 1453 Allen Road., Salem
OH USA, 44460. 216-337-7861. Branch/
Distributors: Scott Industries, Mississauga,
ON; Engineered Pump Systems Ltd.,

Surrey, BC Electrical Industries Ltd.,
Edmonton, AB

Frank E. Dempsey And Sons Ltd. 47
Davies Avenue., Toronto ON, M4M 2A9.
416-461-0844. 416-461-7048. Branch/
Distributors: Lachine, PQ

Design-X-Finishing Systems Ltd. 20
Robb Blvd., Orangeville, ON, L9W 3R2.
519-941-7121. 519-941-8894.

DeVilbiss Ransburg Ind. Liquid Systems
320 Phillips Ave., Toledo, OH, 43612.
419-470-2000. 419-470-2270. Branch/
Distributors: Elec. Coating Equip.,
Mississauga, ON; Dormer Fin. Sys.,
Winnipeg, MB; Finishing Concepts,
Edmonton, AB;

DeVilbiss Ransburg Spray Equip. P.O.
Box 3000, Barrie, ON, L4M 4V6.
705-728-5982. 705-728-5989.

Dexter 845 Edgewater Road., Bronx NY,
10474. 212-542-7700. Branch/
Distributors: Henley Chemicals Ltd,
Scarborough, ON

Diamonte 453 W McConkey Street.,
Shreve OH, 44676. 216-567-2145.

Dilmont Inc. 121 Bates, Montreal Que,
H2V 1B1. 514-272-5741. Branch/
Distributors: Mr. Grant Jeffrey, Toronto,
ON 416-366-1824; Montreal, PQ
514-272-5741;

DL Laboratories 116 East 16th Street,
New York, NY USA, 10003.
212-777-4410. 212-505-8419.

DMP 4016 Promontory Drive,
Mississauga, ON, L5L 3G6. 416-828-1517.
Branch/Distributors: Montreal, PQ

Dominion Colour Corporation 1800
Irontone Manor #2, Pickering, ON, L1W
3J9. 416-837-4000. 416-837-2859. Branch/
Distributors: L. V. Lomas, Brampton,
Montreal, and Vancouver;

Donaldson P.O. Box 1299/M.S. 370.,
Minneapolis MN USA, 55440.
612-887-3900. Branch/Distributors: Carter
Day Ltd., Toronto, ON; Preston Phipps, St.
Laurent, PQ; Ottawa, ON; Dartmouth, NS;
Charlesbourg, PQ; General Equipment,
Vancouver, BC; Edmonton, AB; Calgary,
AB; Winnipeg, MB; Saskatoon, SK

Dover Chemical West 15th at Davis Street,
Dover OH USA, 44622. 216-343-7711.
Branch/Distributors: Van Waters & Rogers,
Downsview, ON

Dow Chemical P.O. Box 1012/Modeland
Rd., Sarnia ON, N7T 7K7. 519-339-3131.
519-339-3824. Branch/Distributors:
Richmond, Calgary, Winnipeg, Etobicoke,
Westmount, Halifax, Edmonton.
Manufacturing Sites: Sarnia, ON, Fort
Sask., AB, Weston, ON, Varennes, PQ.

Dow Corning 6747 Campobello Road.,
Mississauga ON, L5N 2M1. 416-826-9600.
416-858-6005. Branch/Distributors:
Montreal, PQ; Vancouver, BC; Calgary,
AB; Stochem (Dist. Dow Coming Prod.)

Drafswerke Inc. 3 Pearl Court., Allendale
NJ USA, 07401. 201-327-3151. Branch/
Distributors: Unirate Process
Technologies, Burlington, ON

Drake Water Systems Inc. 3329 Mainway
Drive., Burlington ON, L7M 1A6.
905-319-1330. 905-319-1332.

Drew Chemical Limited 525 Finley
Avenue., Ajax ON, L1S 2E5.
905-683-0150. 905-427-0688. Branch/
Distributors: Montreal, PQ & Vancouver,

Drew Industrial Division One Drew Plaza,
Bonton, NJ, 07005. 201-263-7800.
201-263-4483. Branch/Distributors: Drew
Chemical, Aurora, ON;

Dri-Print 329 New Brunswick Avenue.,
Rahway NJ, 07065. 201-382-6800. Branch/
Distributors: Scarborough, ON

Dry Branch Kaolin Company R.R. 1 P.O.
Box 468-0, Dry Branch, GA USA, 31020.
912-750-3500. 912-738-0067. Branch/
Distributors: Debro Inc., Mississauga, ON;
Dorval, PQ; Burnaby, BC;

Dry Clime Lamp Corp. DriQuik Division
1420 West Main Street, Greensburg IN,
47240. 812-663-4141. 812-663-4202.

Dry-Con 840 Halpern Avenue., Dorval PQ,
H9P 1G6. 514-636-1007. Branch/
Distributors: Langley, BC; Plant:
Summerstown, ON Branch: Rexdale, ON

DSA Consulting Inc. Box 1121., Mission
KS, 66222. 913-262-9384.

Dual Div. Met-Pro Corp. 1550 Industrial
Drive, Owosso, MI, 48867. 517-725-8184.
Du-Chem Paint Company Limited 18
Mill Street., Carleton Place ON, K7C 1T9.
613-257-1403.

Duha Color Services 750 Bradford Street.,
Winnipeg MB, R3H 0N3. 204-786-8961.
204-885-3762. Branch/Distributors: Gimli,
Manitoba; Selkirk, Manitoba

Dukes Industries 2237 Water Worries Dr.,
Toledo, OH, 43609. 419-385-7526.
419-389-0309.

Fred A. Dungey Inc. 29 Passmore Ave. Ste.
5, Scarborough, ON, M1V 3H5.
416-293-9580.

Duochem Inc. 1250 Graham Bell.,
Boucherville PQ, J4B 6H5. 514-655-6421.
514-641-4701. Branch/Distributors:
Downsview, ON; Dartmouth, NS; Calgary,
AB; New Westminster, BC;

DuPont Canada Inc. PO Box 2200
Steelesville, Mississauga ON, L5M 2H3.
905-821-3300. 905-821-5592. Branch/
Distributors: Calgary, Montreal

DuraCoat Powder Manufacturing Inc.
13 Iroquois Trail, Grimsby, ON.,
416-945-0073. 416-945-1691.

Dural Div. of Multibond Inc. 550
Marshall Avenue., Dorval PQ, H9P 1C9.
514-636-6230. Branch/Distributors:
Rexdale, ON 416-242-5161;

Durr Industries Inc. 40600 Plymouth
Road, Plymouth, MI, 48170.
313-459-6800. 313-459-5837.

Dussek Campbell Limited P O Box
385/30 Dussek St., Belleville ON, K8N
5A5. 613-966-8881. 613-966-1901.
Branch/Distributors: Van Waters & Rogers
Ltd., Winnipeg, MB; L. V. Lomas Ltd/Ltee.,
Brampton, ON; Dorval, PQ; Surrey, BC

Dynapower Corporation P.O. Box 9210,
South Burlington, VT, 05407.
802-860-7200. 802-864-3782.

E

EMS - American Grilon Inc. Box 1717,
Sumter, SC USA,...

Eastman Chemical Company B-280 P.O.
Box 431, Kingsport, TN USA, 38662.
615-229-2318.

ECC International 5775
Peachtree-Dunwoody, Atlanta GA, 30342.
404-843-1551. 404-843-8872. Branch/
Distributors: Frank E. Dempsey & Sons,
Toronto, ON; Montreal, PQ; Emchem,
Vancouver, BC

Echo Supply 962 Hanson Court, Milpitas,
CA, 95035. 408-945-0325.

Eckert Machines Inc. Box 66, Niagara
Falls, ON, L2E 6S8. 905-356-2742.
905-356-1571.

Eclipse Thermal Systems Ltd. 2095
Madison Avenue, Montreal, PQ, H4B 2T2.
514-482-9770. 514-482-6564. Branch/
Distributors: Mississauga, ON; Calgary,
Edwards High Vacuum, 3375 N. Service
Rd. #B2&B3, Burlington, ON, L7N 3G2.
905-336-9119. Branch/ Distributors:
Vancouver; Montreal;

Eiger Machinery 1258 Allanson Road,
Mundelein IL USA, 60060. 708-970-9800.

Eisenmann Corporation 150 East
Dartmoor Drive, Crystal Lake, IL USA,
60014. 815-455-4100. 815-455-1018.

Elcometer Instruments Ltd., Edge Lane
Droydsden, Manchester England, M35
6BU. 061-370-7611. 061-370-4999.
Branch/ Distributors: Ascol Tool & Gauge,
Cambridge, ON; Graydon Industrial Prod.,
Mississauga, ON; Hamer Tool & Gauge,
Windsor, ON; Intech Supplies, Richmond,
BC; Geneq, Montreal, PQ; Toronto, ON;
QC Instruments, Mississauga, ON; Rideout
Tools & Supply, St. Johns, Nfld.,
Cornerbrook, Nfld.; RAE Inspection
Service, Edmonton, AB; Cedco
Instruments, Milton, ON;

Electrostatic Consultants Co. P.O. Box
1587, Lisle IL USA, 60532. 708-668-5027.
Branch/ Distributors: L.V. Lomas Ltd.,
Brampton, ON;

Electrostatic Coating Equipment Ltd.
270 Brunel Road., Mississauga ON, L4Z
1T5. 905-890-1919. 905-890-7072.
Branch/ Distributors: St-Laurent, PQ

Elektro-Physik USA Inc. 778 W.
Algonquin Road, Arlington Heights, IL,
60005. 708-437-6616. 708-437-0053.
Branch/ Distributors: Frank J. Cox,
Brampton, ON; MacEwan Inspection
Serv., Edmonton, AB;

Electrochemical Products Inc. 17000
Lincoln Ave., New Berlin, WI, 53151.
414-786-9330. Branch/ Distributors: MJM
Morgan Enr., Montreal, PQ;

Electrostatic Technology 4 Pin Oak Drive,
Branford CT USA, 06405. 203-488-8112.

Elf Atochem Canada Inc. 700 Third Line,
Oakville, ON, L6J 5A3. 905-847-4792.

Eltech International Corp. 625 East
Street, Fairport Harbor, OH, 44077.
216-357-4065. 216-357-4077. Branch/
Distributors: PC Tech, Carleton Place, ON;
Elwell-Parker 4205 St. Clair Avenue.,
Cleveland OH USA, 44103.
216-881-6200. Branch/ Distributors:
Horwood-Bullock Ltd. Montreal, PQ, and
Mississauga, ON

Emchem Marketing, 170 Harbour
Avenue., N Vancouver BC, V7J 2E6.
604-987-5274. 604-987-5105. Branch/
Distributors: Calgary, AB; Edmonton, AB;
Winnipeg, MB;

Emco Supply Box 5300/Terminal A.,
London ON, N6A 4N7. Branch/
Distributors: Barrie, Belleville, Calgary,
Comer Brook, Edmonton, Grande Prairie,
Guelph, Halifax, Kitchener, Lethbridge,
London, Medicine Hat, Montreal, North
Bay, Oshawa, Ottawa, Peterborough,
Prince George, Quebec, Regina, Rimouski,
Saint John, Saskatoon, Sault Ste. Marie,
Sherbrooke, St. Catharines, St. John's,
Sudbury, Terrace, Toronto, Ville de
Brossard, Windsor, Winnipeg, Burlington,
Kentville, Trois Rivières, Brandon,
Waterloo

EM Industries Inc. 5 Skyline Drive,
Hawthorne, NY, 10532. 914-592-4660.
914-592-9469. Branch/ Distributors: BDH,
Toronto, ON;

Engelhard Corp. Spec. Min. & Colors
Gr. 101 Wood Avenue, Iselin, NJ,
088300770.

Engelhard Corporation, Menlo Park/CN
28., Edison NJ, 08818. 201-321-5000.
Branch/ Distributors: Stochem Inc.
Brampton, ON; Dorval, PQ MacKenzie &
Feimann Ltd., Western Canada

Enthone-OMI (Canada) Inc. 58 Adesso
Drive, Concord, ON, L4K 3C6.
905-738-1400. Branch/ Distributors:
Enthone-OMI, Pointe Claire, PQ;

Enviroclean 921 Leathorne Street,
London, ON, N5Z 3M7. 800-268-7396.
Envirothane Coatings Inc. 8280 Ross
Street, Vancouver, BC, V5X 4C6.
604-324-2888. 604-324-8899.

Epworth Manufacturing Co. Ltd. 1400
Kalamazoo Street., South Haven MI USA,
49090. 616-637-2128. 616-637-3421.

Everspec Surfaces 89 Taysham Cres.,
Etobicoke, ON, M9V 1X1. 416-741-1220.
416-741-1220.

Evtech 9103 Forsyth Park Drive, Charlotte,
NC, 28273. 800-333-8236.

F

Fabrico Environmental Liners Inc. 4222
S. Pulaski Rd., Chicago, IL, 60632.
800-621-8546. 312-890-5350. Branch/
Distributors: Contact our office for a
Canadian Distributor recommendation.

Fabricated Plastics Limited 2175 Teston
Road., Maple ON, L6A 1T3.
416-832-8161. 416-832-2111. Branch/
Distributors: Edmonton, AB; Surrey, BC;
Montreal, PQ;

Falconbridge Ltd. Box 40 Commerce
Court W., Toronto, ON, M5L 1B4.
416-863-7000.

Fanuc Robotics Canada Ltd. 1411
Courtney Park Drive, Mississauga ON, L5T
2E3. 905-670-5755. 905-670-4046.

Farr Inc. 2785 Francis Hughes Ave.,
Chomedey Laval, PQ, H7L 3J6.
514-384-6401. 514-662-6035. Branch/
Distributors: Farr Inc., Mississauga, ON;
Winnipeg, MB; Vancouver, BC; Altech,
Edmonton, AB; Airtherm, Calgary, AB;
Cypress, Regina, SK; Paul Laflamme,
Ottawa, ON; NB Sales, St. John,
NB; Diamond Mechanical, Halifax, NS

Federated Genco Ltd. P.O. Box 5031,
Burlington ON, L7R 3Y8. 416-637-5203.
Branch/ Distributors: Lachine, PQ

Ferro Industrial Products Ltd. 354 Davis
Road., Oakville ON, L6J 2X1.
416-845-4277. 416-845-9676. Branch/
Distributors: Surrey, BC; Verdun, PQ

Ferox Inc. 9100 Edison, Anjou, QC, H1V
1T3. 514-351-7600. 514-353-1000.

Finishing Engr. Services Inc. 34405 W.
Twelve Mile Rd., Farmington Hills, MI,
48331 5628. 313-489-1590. 313-489-8996.
Filtration Kenbec Ltd., 7351 Chouinard.,
Lasalle, PQ, H8N 2L6. 514-364-0341.
514-366-2110. Branch/ Distributors: Paul
Laflamme Ind., Ottawa, ON; Seca Enr.,
Quebec City, PQ;

Filterite Memtec America Corp. 2033
Greenspring Drive, Timonium MD, 21093.
301-252-0800. 301-252-6027. Branch/
Distributors: JKS Ventures Company,
Loreto, MB; First Filter Service,
Saskatoon, SK; HSI Hydrosystems Div.,
Langley, BC; The Jeffery Group,
Richmond, BC; McGreagor-Sharp
Filtering, Edmonton, AB;

Finishing Concepts 9707-42 Avenue,
Edmonton, AB, T5M 3N7. 403-436-6466.
403-438-2019. Branch/ Distributors:
Branch Locations: Calgary, AB; Vancouver,
Finish Thompson Inc. 921 Greengarden
Road., Erie PA USA, 165011591.
814-455-4478. 814-455-8518.

Fire and Smoke Stop Products Inc. 490
Des Meurons Street., Winnipeg MB, R2H
2P5. 204-233-0800. Branch/ Distributors:
St. John's, NF; Halifax, NS; Toronto, ON;
Winnipeg, MB; Regina, SK; Calgary, AB;
Edmonton, AB; Vancouver, BC

Fischer Technology Inc. 750 Marshall
Pheps Road, Windsor, CT, 06095.
800-243-8417. 203-688-8496.

Fleming Gray Ltd. 690 Bishop Street.,
Cambridge ON, N3H 4S6. 519-653-2400.
Branch/ Distributors: Clares Repairs Ltd.,
Vancouver, BC;

Flex-Kleen Corp. One Pierce Place
Ste. 1500, Itasca, IL USA, 601432641.
708-775-0707. 708-775-1158. Branch/
Distributors: Flex-Kleen Corp, Richmond
Hill, ON

Flexo Products Inc. 24864 Detroit Rd.,
Westlake OH, 44145. 216-871-6030.
Branch/ Distributors: Wasip Inc.,
Scarborough, ON

Flo King Filter Systems 1320 Bennett Dr., Longwood, FL 32750. 407-331-4634. Branch/Distributors: Brudac Canada, Dorval, PQ; Hartek Controls, Rosemont, ON;

Fluid Management Ltd. Partnership 1023 S. Wheeling Road, Wheeling, IL USA, 60090. 708-537-0880. 708-537-5530.

Flux Pumps Corporation 4330 Commerce Circle, Atlanta, GA 30336. 404-691-6010. 404-691-6314. Branch/Distributors: Les Plastiques Cy-Bo Inc., St. Laurent, (Mtl.) Quebec.

FMT Inc. 1950 Industrial Drive, Findlay, OH USA, 2126050. 419-422-0768. 419-922-0722.

Folio Instruments Inc. 260 Manitou Drive #3, Kitchener, ON, N2C 1L3. 519-748-4612. 519-748-1535. Branch/Distributors: Montreal; Vancouver; Ottawa; Calgary;

Folio Instruments Inc. 5475 Royalmount Unit 124, Mount Royal, PQ, H4P 1J3. 514-735-0666. Branch/Distributors: Montreal; Vancouver; Ottawa; Calgary;

Formax Mfg. 3178 Bellevue Avenue., Detroit MI, 48207. 313-921-7030. 313-922-5210. Branch/Distributors: Scarborough, ON

Fostoria Ind. Inc. 1200 North Main Street., Fostoria OH, 44830. 419-435-9201. 419-435-0842. Branch/Distributors: Williams & Wilson Ltd., Montreal, PQ Scarborough, ON

Franklin Mineral 635 Main Street., Wilmington MA, 01887. 508-658-2310. Branch/Distributors: Prescott & Co., Montreal, PQ; Pigment & Chemical Inc., Milton, ON

Frank J. Cox Sales Ltd. 40 West Drive., Brampton ON, L6T 3T6. 905-457-9190. 905-457-3120.

S.G. Frantz P.O. Box 1138., Trenton NJ, 08606. 609-882-7100. Branch/Distributors: Kirk Equipment Ltd., Montreal, PQ

Fred Cressman Sales Inc. 264 Sunview Street., Waterloo ON, N2L 3V9. 519-884-3225. 519-884-1326.

Freeman Polymers Division, 217 Freeman Drive., Port Washington, WI USA, 53074. 800-558-8658. Branch/Distributors: Ashland Chemical, Resin Div., Mississauga, ON;

Fryma Inc. 40 Ethel Road., Edison NJ, 08817. 908-248-0700.

Fryston Canada Inc. 7370 Bramalea Rd. Ste. 30, Mississauga, ON, L5S 1N6. 905-612-0566. 905-612-0575.

H.B. Fuller P.O. Box 2040., Bethlehem PA, 18001.. Branch/Distributors: Fuller Taylor Ltd., Scarborough, ON, Montreal, PQ

G

Gasmac Inc. 509 Clair Road West., Guelph, ON, N1H 6H9. 519-836-5362. 519-836-4242.

Gema Viscatic Ind. Powder Systems 3939 West 56th Street, Indianapolis, IN USA, 46254. 800-628-0601. 317-298-5881. Branch/Distributors: Gema Viscatic, Dorchester, ON; E.C.E. Toronto & Montreal; Finishing Concepts, Edmonton, Gemite Products Inc. 2244 Drew Road, Mississauga, ON, L5S 1B1. 905-672-2020.

Geneq Inc. 223 Signet Drive., Toronto, ON, M9L 1V1. 416-747-9889. 416-747-7570. Branch/Distributors: Geneq Inc., Montreal, PQ

General Fabrications Corporation 7777 Milan Road, Sandusky, OH USA, 44839. 419-625-6055. 419-625-7843.

General Filtration 1119 Yonge Street., Toronto ON, M4W 2L7. 416-924-9349. 416-960-8750. Branch/Distributors: Montreal, PQ; Phone: 514-848-7219

Genstar Stone Executive Plaza IV, Hunt Valley MD USA, 21031. 410-527-4225. Branch/Distributors: Debro Chemicals, Mississauga, ON; Debro Chemicals, Dorval, PQ;

George Koch Sons Inc. 10 South 11th Avenue., Evansville IN, 47744. 812-465-9704. 812-465-9724. Branch/Distributors: 207 Edgeley Blvd., Ste. 25, Concord, ON; 905-669-2230

George Fischer 2882 Dow Avenue, Tustin, CA, 92680. 714-731-8800.

Georgia Marble 1201 Roberts Blvd #100., Kennesaw GA USA, 301443619. 404-421-6540. 404-421-6507. Branch/Distributors: Chemroy Chemicals Ltd., Mississauga, ON; Ferro Ind. Prod., Surrey, BC.

Geo. Olcott P.O. Box 783., Scottsboro AL USA, 35768. 800-634-2769. 205-259-4937. Branch/Distributors: R.R. McGlogar Equipment, Kitchener, ON

Glant Distillation 900 North Westwood Avenue, Toledo Ohio, 43607. 419-531-4600.

Giffin Contractors 133 Bridgeland Avenue, Toronto, ON, M6A 1Y7. 416-781-6166. 416-781-9977.

Giles Tool Agencies Limited 6520 Lawrence Ave. E., Scarborough ON, M1C 4A7. 416-287-3000.

GLA 38830 Taylor Parkway, North Ridgeville OH, 44039. 216-327-3323.

Gorman-Rupp of Canada Limited 70 Burnwell Road., St. Thomas ON, N5P 3R7. 519-631-2870. 519-631-4624.

John E. Goudey Mfg. Ltd. 21 Primrose Avenue., Toronto ON, M6H 3V1. 416-531-4669.

Grace Davison P.O. Box 2117, Baltimore, MD, 21203. 410-659-9072. 410-659-9213. Branch/Distributors: Stochem Inc., Brampton, ON, Lachine, PQ.

Graco Canada Inc. 3400 American Drive., Mississauga ON, L4V 1C1. 905-677-0640. 905-677-3991.

Grace Dearborn Inc., 3451 Erindale Station Rd., Mississauga, ON, L5A 3T5. 905-279-2222. 905-279-0020. Branch/Distributors: Halifax, NS; St. John, NB;

Quebec City, Que.; Montreal, Que.; Brockville, ON; Burlington, ON; Toronto, ON; London, ON; Sarnia, ON; North Bay, ON; Winnipeg, MB; Calgary, AB; Edmonton, AB; Richmond, BC.

Gray Products - L & F Canada Inc. 245 Edward Street, Aurora, ON, L4M 3M7. 905-841-7600. 905-841-3996.

Graymills Corporation 3705 N. Lincoln Ave., Chicago IL, 60613. 312-477-4100. 312-477-8673. Branch/Distributors: Edward H. Pope Ltd., Brampton, ON;

Great Western Containers, 7400 MacPherson Ave. #206, Burnaby, BC, V5J 5B6.

Greenfield Ventures 14324/25 Avenue., Surrey BC, V4A 5Z2. 604-535-0033. 604-538-5571.

Greey Lightnin 100 Miranda Avenue., Toronto ON, M6B 3W7. 416-781-6105. Branch/Distributors: T.D. Rooke, Toronto, ON; Nortec S.G.S., Montreal, PQ; Dartmouth, NS; Zazula Process Equipment Ltd., Calgary, AB; Black & Baird, Vancouver, BC; Nothart Engr. Sales Ltd., Winnipeg, MB;

Gurtin Bros. Coatings And Sealants Ltd. 50 Panet Road., Winnipeg MB, R2J 0R9. 204-237-0241. 204-233-5051. Branch/Distributors: Rexdale, ON; St. Clair Beach, ON; Cowansville, PQ; Ville D'Anjou, PQ; Winnipeg, MB; Regina, SK; Edmonton, ON; Calgary, AB; Surrey, BC.

Guspro POB 970/280 Grand Ave. E., Chatham ON, N7M 5L5. 519-352-4550. Branch/Distributors: Craig McGregor, Winnipeg, MB; Paul Coghlin, Atwood, Tony Waldegrave, Oakville, ON; Eric Berge, Mississauga, ON; Gordon Baker, Guy Magnan, Montreal, PQ; David Carter, Vancouver, BC; Brian Morris, Edmonton. **Gyromat** 200 Elliot Street., Fairfield, CT, 06430. 203-259-1621.

H

Haartz-Mason Inc., 270 Pleasant St., Watertown, MA USA, 02272. 617-926-2300. 617-923-3080. Branch/Distributors: Construction Dist. & Supply, Downsview, ON.

Haas Corporation, 1235 Cardiff Blvd., Mississauga, ON, L5S 1M8. 905-641-2626. 905-564-1016.

Hadley Telescience 1100 Invicta Dr. Unit 22, Oakville ON, L6H 2K9. 416-844-1762. Branch/Distributors: Richmond, BC; R.P. Instruments, Montreal, PQ

Haltech Inc. 465 Coronation Drive., West Hill ON, M1E 2K2. 416-284-6111. 416-284-6932. Branch/Distributors: Polycol Ltd., Pointe Claire, PQ

Halox Pigments 2340 165th St., Hammond, IN USA, 46320. 219-845-4599. 219-845-7138. Branch/Distributors: Frank Dempsey & Sons, Toronto & Lachine; Horizon Chemical, Richmond, BC.

Hamilton Thermal Specialties Ltd. 422 Seaman Street, Stoney Creek, ON, L8E 3P3. 416-664-2396. 416-561-0323.

Hammond Machinery 1600 Douglas Avenue, Kalamazoo MI, 49007. 616-345-7151.

Hampshire Chemical Corporation 55 Hayden Avenue, Lexington MA, 02173. 617-861-9700.

Handi-Blast RR., What Cheer IA, 50268. 515-634-2679.

Handy Chemicals 745 Ste. Rose Street., LaPrairie PQ, J5R 1Z2. 514-659-9693. Branch/Distributors: Toronto, Ottawa, Montreal

Hankison 1000 Philadelphia Street., Canonsburg PA, 15317. 412-745-1555. Branch/Distributors: Distributors in all major cities.

Harcros Pigments Canada 36 Towns Rd., Toronto, ON, M8Z 1A3. 416-251-1161. 416-251-4774. Branch/Distributors: Harcros Pigments, Quebec & Maritimes, 1-800-265-2987; West Dist., Van Waters & Rogers Winnipeg-Vancouver-Calgary-Regina-Saskatoon-Edmonton.

Van Waters 777 Superstee Road., Downsview ON, M3J 2M5. 416-736-9299. Branch/Distributors: Harcros Pigments, Quebec & Maritimes, 1-800-265-2987; West Dist., Van Waters & Rogers Winnipeg-Vancouver-Calgary-Regina-Saskatoon-Edmonton.

Hardwood Line 4045 N. Elston Ave., Chicago, IL, 60618. 312-463-2600.

Harper Surface Finishing Sys. Inc. 70 Gracey Avenue., Meriden CT, 064550688. 203-630-0550. 203-630-0346.

Harcros Pigments 36 Towns Rd., Etobicoke, ON, M8Z 1A3. 416-251-1161.

Hart Chemical 256 Victoria Road South., Guelph ON, N1H 6K8. 519-824-3280. Branch/Distributors: Harrisons & Crosfield (Canada) Ltd., Toronto, ON Canada Colors & Chemicals Ltd., Toronto, ON

Haviland Engineering 421 Ann St. N.W., Grand Rapids, MI USA, 49504. 616-361-6691. Branch/Distributors: M. LeBlanc & Assoc., Willowdale, ON; M.I.E. Canada Co., Lachine, PQ

Hayward Gordon 6660 Campobello Road, Mississauga ON, L5N 2L9. 416-677-6400. Branch/Distributors: Dorval, PQ; Calgary, AB; Vancouver, BC;

Heatbath Corporation P.O. Box 2978., Springfield MA, 01101. 413-543-3381. 413-543-2378. Branch/Distributors: Apco Industries Co. Ltd. Toronto, ON

Hempel Coatings 300 St. Sacramento, Montreal PQ, H2Y 1X4. 514-842-1166. 514-842-2332.

Henkel Canada Limited 2290 Argenta Road, Mississauga, ON, L5N 6H9. 905-542-7554. 905-542-7588. Branch/Distributors: Chemroy Canada, Mississauga, ON; Laval, PQ; Delta, BC;

Henley 420 Finchdene Square., Scarborough ON, M1X 1C2. 416-297-0999. Branch/Distributors: Montreal, PQ; Vancouver, BC;

John T. Hepburn 7450 Torbram Road., Mississauga, ON, L4T 1G9.

Heraeus DSET Laboratories Inc. 45601 N. 47th Ave., Phoenix, AZ USA, 850277042. 602-465-7356.

Heraeus DSET Laboratories Inc. 45601 N. 47 Avenue, Phoenix, AZ, 85027. 602-465-7356. 602-465-9409.

Heresite 822 South 14th Street., Manitowoc WI, 54220. 414-684-6646. Branch/Distributors: Madok Mfg. Ltd., Brantford, ON; Engineered Air, Calgary, AB

HERO 2719 Lake City Way., Burnaby BC, V5A 2Z6. 604-420-6543. Branch/Distributors: Larry Douglas, Tweed, ON 416-464-5027

John Herring 15213 Yonge Street, Aurora ON, L4G 1L8. 905-727-1345. 905-841-3785.

Hex Valve 3170 Wasson Rd., Cincinnati OH USA, 45209. 513-533-5600.

Higginson Equip. Sales Ltd. 1131 Penit Rd/Box 5011., Burlington ON, L7R 3Z4. 905-335-2211. 905-335-8756.

Hiross Canada Inc. 2180 Dunwin Drive Unit 7, Mississauga ON, L5L 1C7. 905-828-5530. 905-828-5018.

Hitox Corp. of America P.O. Box 2544., Corpus Christi TX, 78403. 512-882-5175. 512-882-6948. Branch/Distributors: Debro Chemicals, Mississauga, ON; Dorval, PQ; Burnaby, BC;

Hockmeyer Equipment Corporation 610 Worthington/PO Bx 113, Harrison NJ, 07029. 201-482-0225. 201-484-6114. Branch/Distributors: L.V. Lomas, Brampton, ON; Dorval, PQ;

Hoechst Canada Inc. 4045 Cote Vertu., Montreal PQ, H4R 1R6. 514-333-3500. 514-333-3751. Branch/Distributors: Willowdale, ON; Coquitlam, BC

Honeywell 155 Gordon Baker Road., North York ON, M2H 3N7. 416-499-6111. Branch/Distributors: Toronto, ON; Hamilton, ON; Samia, ON; Windsor, ON; Sudbury, ON; Ottawa, ON; Montreal, PQ; Quebec, PQ; Halifax, NS; Moncton, NB;

Sherbrooke, PQ; St. John's, NF; Winnipeg, MB; Calgary, AB; Regina, SK; Saskatoon, SK; Edmonton, AB; Vancouver, BC

Hoover Color P.O. Box 218 State Hwy 693, Hiwassee, VA USA, 24347. 703-980-7233. 703-980-8781. Branch/Distributors: Chemroy Chemicals Ltd. Mississauga, ON Montreal, PQ

Hoover Group 700 S. Seventh Street., Beatrice NE, 68310. 402-223-2324. Branch/Distributors: Cassier Engineering Sales, Scarborough, ON

Horizon Chemicals Ltd. 2-10522 Kozier Dr., Richmond BC, V7E 5L8. 604-272-2961. 604-272-7964.

Hosokawa Micron 1940 Steeles Ave. East., Brampton, ON, L6T 1A7. 905-791-3883.

E.F. Houghton 100 Symes Road., Toronto ON, M6P 3J5. 416-763-4691. Branch/Distributors: Vancouver, BC; McQuaig

Agencies, Winnipeg, MB; Seaboard Ind. Supply, Glace Bay, NS

J.M. Huber Corporation, Chem. Div. 907 Revolution St Box 310, Havre De Grace MD, 20178. 410-939-3500. 410-939-7313. Branch/Distributors: L.V. Lomas Chemical, Dorval, PQ; Brampton, ON; New Westminster, BC;

Huls Canada 235 Orenda Road., Brampton, ON, L6T 1E6. 905-451-3810. 905-451-4469. Branch/Distributors: Montreal, PQ; Richmond, BC; Fort Garry, MB;

Huml Seal 26-60 Brooklyn Queens Exy, Woodside NY, 11377. 718-932-0800. Branch/Distributors: Paisley Products of Canada Ltd., Scarborough, ON

Hunter Douglas 214 Courtland Avenue, Concord, ON, L4K 4L3. 416-660-4333. 416-660-4395.

Hunter Drums 1121 Pioneer Rd., Burlington ON, L7M 1K5. 416-335-5201. Branch/Distributors: E & E Containers, Calgary, Nisku, Alberta; Kay Containers, Winnipeg, MB

Huntington Labs. of Canada Limited 15 Victoria Crescent., Bramalea ON, L6T 1E3. 905-791-2336. 905-791-2319. Branch/Distributors: Edmonton, Winnipeg, Montreal, Halifax, Cape Breton, Peterborough, Toronto, London, Hamilton, Kingston, Vancouver, Ottawa.

Huntington Energy Systems Inc. 1081 Bristol Rd., Mountainside, NJ USA, 07092. 908-789-2700. 908-789-2709. Branch/Distributors: Formerly JWP Air Technologies;

K.H. Huppert 16850 S State St., Holland IL USA, 604732881. 708-339-2020. 708-338-2225. Branch/Distributors: Micro Metallurgical Ltd., Richmond Hill, ON

ICI Paints 1330 Castlefield Avenue., Toronto ON, M6B 4B3. 416-787-2411.

ICI Polys P.O. Box 1085., Brantford ON, N3T 5T2. 519-756-6181.

ICI Product 90 Sheppard Ave. East., North York, ON, M2N 6H2. 416-229-7353. 416-229-7440.

ID1 Inc. 33 Laird Drive, Toronto, ON, M4G 3S9. 416-696-2553. 416-425-4858.

Imperial Oil Chemicals Division 111 St. Clair Ave. West, Toronto ON, M5W 1K3. 416-968-4252. 416-968-4256. Branch/Distributors: Toronto, Montreal, Vancouver Indeco Inc., P.O. Box 589., New Albany, IN USA, 47150. 812-945-4383. 812-944-9742

Industrial Coatings 800 Garyray Drive., Weston ON, M9L 1X1. 416-741-5620. Branch/Distributors: Speedflo;

Industrial Colours And Chemicals Limited 235 Advance Blvd., Brampton ON, L6T 4J2. 905-453-7131. 905-453-0199.

Industrial Containers Ltd. 100 North Queen Street, Toronto, ON, M8Z 2E2.

416-231-5020. 416-231-3586. Branch/Distributors: Vancouver, BC; Edmonton, AB; Winnipeg, MB; Montreal, PQ.

Industrial Filter & Pump Mfg. Co. 5900 Ogden Avenue, Cicero, IL. 606503888. 708-656-7800. 708-656-7806.

Industrial Finishing Systems Inc. 10 Banfield Ave., Markham ON, L3P 1H2. 905-471-5760. 905-294-5612.

Infratrac 646 South 29th St., Milwaukee, WI. 53216. 414-671-7140.

Ingersoll-Dresser Pumps (Canada) Inc. P.O. Box 40., Brantford ON, N3T 5M5. 519-753-7381. 519-753-0845. Branch/Distributors: Sansom Equip. Ltd., St. Johns, NF; Sansom Equipment Ltd., Fredericton, NB and Smith Cameron Industrial Inc., Coquitlam, BC. Cdn. Sales Office: Calgary, AB; Cambridge, ON; Truro, NS; Scot Industrial Inc., Montreal, PQ; M-K Process Equipment Ltd., Mississauga, ON and Sudbury, ON; Power & Mine Supply, Thunder Bay, ON; John Brooks, Toronto, ON; Power and Mine Supply, Thunder Bay, ON; PSI Pontech Serv., St. Laurent, PQ; Power & Mine Supply, Winnipeg, MB; Saskatoon, SK; Smith-Cameron Ind., Calgary, AB.

Ingersoll-Rand Canada Inc. 2360 Millrace Court, Mississauga, ON, L5N 1W2. 416-858-8480. Branch/Distributors: Rexdale, ON; Richmond, BC; Kirkland, PQ; Dist. Coast to Coast in all Major Cities:

Ingersoll-Rand Canada 51 Worcester Road., Rexdale ON, M9W 4K2. 416-675-5611.

Inmat Canada Inc. 2179 Adair Crescent, Oakville, ON, L6J 5J6. 905-338-2168. 905-844-5453.

O.G. Innes Corporation 172 Madison Avenue., New York NY, 10016. 212-679-6180. 212-889-5967. Branch/Distributors: A.S. Paterson Co. Ltd., North York, ON.

Inortech Chimie Inc. 400 Blvd. St. Martin O., Laval, PQ, H7M 3Y8. 514-967-4993. 514-967-7268. Branch/Distributors: Branch: Mississauga, ON, (Toronto) Ontario

Intercomp Inc. 3628 W. Pierce St., Milwaukee, WI USA. 532151030. 414-383-2021. 414-383-6725. Branch/Distributors: Representing: Wolkem Pty. Ltd., P.I. Industries Ltd.

Interlab Paints 490 Des Meurons Street., Winnipeg MB, R3N 1B8. 204-233-0800. 204-237-5534. Branch/Distributors: Calgary, AB.

IPEC P.O. Box 354., Cambridge ON, N1R 5V4. 519-621-0479.

Ishihara Corporation (USA) 600 Montgomery Street, San Francisco, CA USA. 94111. 415-421-8207. 415-397-5403. Branch/Distributors: L.V. Lomas (for organic colored pigments)

ISP (Canada) Inc. 1075 The Queensway East., Mississauga ON, L4Y 1R8. 416-277-0381. 416-272-0552. Branch/Distributors: Montreal

ITT Fluid 55 Royal Road., Guelph ON, N1H 1T1. 519-821-1900. 519-821-2569. Branch/Distributors: Representatives: Garson, ON; Vancouver & Langley, BC; Bedford, NS; Regina, SK; Edmonton & Calgary, AB; Saint John, NB; London, ON; St. John's, Nfld.; Saskatoon, SK; Winnipeg, MB; Montreal, PQ.

J

Jaico Associates P.O. Box 505, Woburn, MA, 018010505. 617-935-2753. 617-391-8922.

Jayo Inc. 40 Whitney Road., Mahwah NJ USA, 07430. 201-848-0200. 201-891-1174. Branch/Distributors: Cooke Chemicals Ltd., Rexdale, ON

J.B.I. Inc. Spray Booths and Systems P.O. Box 38 801 Norway Rd, Osseo, WI USA. 54758. 715-597-3168. 715-597-2193.

Jema-American Box 206., Dunellen NJ, 08812. 908-968-5333. 908-968-1269.

Jiffy Mixer 4120 Tigris Way., Riverside CA, 925034843. 909-272-0838. 909-279-7651. Branch/Distributors: H.W. Bickle Co., Niagara Falls, ON; Bunks Mfg. Co., Toronto, ON; Canadian Ceramic Wholesalers, Surrey, BC; Greenbarn Pottery Supply, Surrey, BC; Proseal

Concrete Floor Care Sys., Mississauga, ON; Tucker's Pottery, Markham, ON; Chemtron Mfg., Calgary, AB; Pacific Rim, Vancouver, BC; Culpepper, Calgary, AB;

Tremco, Toronto, ON; Homestead Cer. Whse., Willowdale, ON; Universal Foam Sys., Balckie, AB; Atlantic Pottery Supplies, Dartmouth, NS Fleck Bros. Ltd., Burnaby, BC; Joyce Ceramic Supplies, Sturgeon Falls, ON;

Johnson Matthey 130 Glidden Road, Brampton ON, L6W 3M8. 905-453-6120.

Johnson & Johnson Inc. 2155 Pie IX Blvd., Montreal PQ, H1V 2E4. 514-251-5151. 514-251-5138. Branch/Distributors: Arslan Automotive, Master Dist. - Aftermarket Products:

S.C. Johnson 1525 Howe Street/070., Racine WI USA, 53403. 414-631-4875. Branch/Distributors: S.C. Johnson & Son Ltd., Mississauga, ON

Jordan Valve 3170 Wasson Rd., Cincinnati OH USA. 45209. 513-533-5600. Branch/Distributors: Markland Industrial Supplies, Halifax, NS Robin & Neron Ltd., Montreal, PQ; Saskatoon Boiler Mfg. Co. Ltd. Jenkinson & Co. Ltd., Toronto, ON Saskatoon, SK Wescan Systems Ltd., Vancouver, BC;

K

Kali-Chemie 41 West Putnam Avenue., Greenwich CT USA. 06830. 203-629-7900. Branch/Distributors: Stochem Inc., Mississauga, ON

H.G. Kallish Inc. 165 Oneida Drive., Pointe Claire PQ, H9R 1A9. 514-694-2390. 514-694-6552. Branch/Distributors: Mississauga, ON

Karutek Inc. 6790 A Pacific Circle, Mississauga, ON, L5T 1N8. 905-564-3531. 905-564-3476.

KelCoatings Limited 97 White Oak Road., London ON, N6E 1L8. 519-681-1140. 519-681-4263. Branch/Distributors: Toronto, Cambridge, Montreal

Kentain Products Ltd. 55 Howard Place., Kitchener ON, N2K 2Z4. 519-576-0994. 519-576-0919.

Kentucky-Tennessee P.O. Box 6002, Mayfield, KY. 42066. 502-247-3061. 502-247-0293. Branch/Distributors: Subsidiary Comp K-T Feldspar Corp., P.O. Box 309, Spruce Pine, NC, 704-765-9621;

Kerr-McGee Chemical Corp. 123 Robert S. Kerr, Oklahoma City, OK, 73102. 405-270-1313. 405-270-3123. Branch/Distributors: Stochem, Brampton, ON & Lachine, PQ;

Kinetic Dispersion Corp. P.O. Box 847, Scarborough ME USA, 040700847. 207-883-4141. 207-883-8241. Branch/Distributors: Montreal, PQ

King Industries Inc. Science Road, Norwalk CT USA, 06852. 203-866-5551. 203-866-1268. Branch/Distributors: Stochem, Brampton, ON; Lachine, PQ; North Vancouver, BC.

Kingsley & Keith 1010 Deserigny., Longueuil, PQ, J4K 5G7. 514-442-4394. Branch/Distributors: Longueuil, PQ; Vancouver, BC

Kirk Equipment Ltd. 2535 Cavendish Blvd./#203, Montreal PQ, H4B 2Y5. 514-481-7795. 514-481-7797. Branch/Distributors: Toronto, ON

Klinter Inc. P.O. Box 3660, Brantford, ON, N3T 6H2. 519-758-1508. 519-758-1490. Branch/Distributors: Bondwell Adhesives, Toronto, ON; Bellare Ind. Coatings, Calgary, AB; Insul-mastic & Bldg. Prod., Vancouver, BC; Royal City, Guelph, ON;

KMG Minerals P O Box 729., Kings Mountain NC USA, 28086. 704-739-1321. Branch/Distributors: Frank E. Dempsey & Sons, Toronto, ON; Cascade Marketing Ltd., Vancouver, BC;

Koch Membrane 850 Main Street, Wilmington, MA, 01887. 508-657-4250.

Kolene 12890 Westwood Avenue, Detroit MI, 48223. 313-273-9220. 313-273-5207.

Korzite Coatings Inc. P.O. Box 1175., Guelph ON, N1H 6N3. 519-821-1250. 519-821-9291.

Kremlin Canada Inc. 31 Progress Court/7., Scarborough ON, M1G 3V5. 416-431-5017. 416-431-9171. Branch/Distributors: Kremlin (Quebec), Montreal, PQ; Distribution across Canada.

Kronos Canada Inc. 4 Place Ville Marie/500, Montreal PQ, H3B 4M5. 514-397-3501. 514-397-0580. Branch/Distributors: Vancouver, BC, North York, ON;

Kryton International Inc. 8280 Ross Street., Vancouver, BC, V5X 4C6. 604-324-8280. 604-324-8899.

KTA-Tator 115 Technology Drive.,
Pittsburgh PA USA, 15275. 412-788-1300.

Kudzu Technologies Ltd. 6 Homestead
Court, Markham, ON, L3P5C3.
416-471-7351. 416-471-1260.

L

Lab-Line 15th & Bloomingdale Ave.,
Melrose Park IL USA, 60160.
708-450-2600.

LaMotte Box 329., Chestertown MD,
21620. 301-778-3100.

Landers-Segal 84 Dayton Avenue, Passaic,
NJ USA, 07055. 201-779-5001.
201-779-8948.

Laques International Inc. 9100 Edison,
Anjou, PQ, H1J 1T3. 514-354-1312.
514-353-1000. Branch/Distributors: Les
Saules, PQ; Calgary, AB;

Laurentide 4660 12th Ave/PO Box 367.,
Sawinigan Sud PQ, G9N 6V2. Branch/
Distributors: Richibucto, NB Montreal,

Lawter Intl. (Canada) Inc. 29 Iron Street.,
Rexdale ON, M9W 5E3. 416-247-8648.

LCI Corporation P.O. Box 16348.,
Charlotte NC, 282978804. 704-394-8341.
Branch/Distributors: Extrusion Systems
Inc. Markham, ON;

The Leneta Company 15 Whitney Rd.,
Mahwah, NJ USA, 07430. 201-847-9300.
201-848-8833. Branch/Distributors: J.B.
Atlas Co., Rexdale, ON

Lepel 50 Heartland Blvd., Edgewood NY,
11717. 516-586-3300. Branch/
Distributors: Burton Industries, Waterloo,
ON;

Lewis Corporation 102 Willenbrock Rd.,
Oxford, CT, 064781033. 203-264-3100.
203-264-3102. Branch/Distributors:
Waters Metal Products Ltd. Niagara Falls,
ON

Lind Equipment Ltd. 7280 Victoria Pk.
Ave.#D, Markham, ON, L3R 2M5.
905-475-5086. 905-475-4098.

Lion Shipping 5650-A Timberlea Blvd.,
Mississauga ON, L4W 4M6.
416-625-6830. Branch/Distributors:
Montreal, PQ

Liquid Controls 105 Albrecht Drive, Lake
Bluff, IL, 60064. 708-295-1050.

Liquid Development 3748 East 91st
Street, Cleveland, OH, 44105.
216-641-9366. 216-641-6416. Branch/
Distributors: Dalcen Services, Burlington,
ON;

LMG Reliance 510 Bronte Street South,
Milton, ON, L9T 2X6. 905-878-8826.
Branch/Distributors: Winnipeg, MB;
Vancouver, BC;

Logan Actuator Co. 4956 N. Elston
Avenue., Chicago IL, 60630.
312-736-7500. 312-736-6854. Branch/
Distributors: Higginson Equipment Sales
Ltd. Burlington, ON

L.V. Lomas Limited/Limitee 99
Summerlea Road., Brampton ON, L6T
4V2. 905-458-1555. 905-458-0772.

Branch/Distributors: Dorval, PQ; New
Westminster, BC;

Loraz 17 - 17 Route 208., Fair Lawn NJ,
07410. 201-794-2400. Branch/
Distributors: Canada colors & Chemicals,
Toronto, ON

Lorame 221 Nipissing Rd., Milton ON,
L9T 1R3. 416-878-2833. Branch/
Distributors: Mackenzie & Feimann

Lord Corporation Ind. Coatings 2000 W.
Grandview Blvd., Erie PA USA,
165140038. 814-868-3611. Branch/
Distributors: Quadra Chem. Ltd.,
Burlington, ON; 416-336-9133

LubeCon Systems Inc. 6735 W.64th St.
Box 589, Fremont, MI, 494120589.
616-924-0653. 616-924-6147. Branch/
Distributors: Winnipeg, MB; Orangeville,
ON; Lunenburg, ON.

Lubrizol 29400 Lakeland Blvd., Wickliffe
OH, 44092. 216-943-4200. Branch/
Distributors: Chemroy Chemicals Ltd.,
Mississauga, ON

Luzeac Inc. 1075 N Service Rd W/S 14.,
Oakville ON, L6M 2G2. 905-825-3930.
905-825-3932. Branch/Distributors: L.V.
Lomas Ltd., Brampton, ON; Dorval, PQ;

M

3M Canada Inc. P.O. Box 5757., London
ON, N6A 4T1. 519-451-2500.

519-452-6103. Branch/Distributors:
Calgary, AB Montreal, Dorval, PQ
Toronto, ON Vancouver, BC Winnipeg,
MB; Ottawa, ON;

Macbeth 405 Linle Britain Rd., New
Windsor, NY, 125536148. 914-565-7660.
Branch/Distributors: Prism Inst., Whitby,
ON;

MacKenzie and Feimann Limited Ste.
311/255 W. First St., N. Vancouver BC,
V7M 3G8. 604-980-7055. 604-980-4550.
Branch/Distributors: Delta, BC; Edmonton,
AB; Pointe Claire, PQ; Calgary, AB;
Regina, Saskatoon, SK; Winnipeg, MB;
Oakville, ON;

MacDonald And White Varnish & Paint
1106 Walker Rd., Windsor, ON, N8Y 2N7.
519-252-7275. 519-252-7278.

Madison Chemical Industries Inc. 490
McGeachie Drive., Milton ON, L9T 3Y5.
416-878-8863. 416-878-1449.

Magic Rack/Production Plus Corp. 691
Harmon Plaza, Columbus, OH USA,
43223. 614-443-4673. 614-443-4674.

Magnus Chemicals Ltd., 190 Boul.
Industriel., Boucherville PQ, J4B 2X3.
514-655-1344. 514-655-5428. Branch/
Distributors: Magnus, Mississauga, ON;
Pritchard Dist., Winnipeg, MB;

Malcolm Campbell & Son Ltd. 1248
Franklin Street, Vancouver, BC, V6A 1K1.
604-255-8491. 604-255-8393. Branch/
Distributors: Malcolm Campbell & Sons,
Saskatoon, SK; Winnipeg, MB; Nanaimo,
Manchester Corp. 280 Ayer Rd. PO Box
317, Harvard, MA, 01451. 508-772-2900.
508-772-7731. Branch/Distributors: H.C.
Madigan, Cardigan, PEI;

M&T Harshaw Canada 1180 Corporate
Drive., Burlington, ON, L7L 5R6.
416-332-0111. 416-332-0841. Branch/
Distributors: Empire Buff Ltee, St. Vincent
de Paul, PQ;

Maple Roll 2285 Ambassador Drive.,
Windsor ON, N9C 3T5. Branch/
Distributors: Downsview, ON; Montreal,
PQ

Marathon Industrial Products 91 Station
Street Unit 11, Ajax, ON, L1S 3H2.
905-683-9905. 905-683-0385.

Markem 149 Manitou Drive, Kitchener
ON, N2C 1L4. 519-893-7055. Branch/
Distributors: 9645 Cote De Liesse, Dorval,
PQ

Markland Spec. Eng. Ltd. 48 Shaft Road.,
Rexdale ON, M9W 4M2. 416-244-4980.
416-244-2287. Branch/Distributors:
Marig Inc., Montreal, PQ; Pyramid
Measurement, Vancouver, BC

Martin Marietta Magnesia Specialties
P.O. Box 15470, Baltimore, MD,
21200470. 410-780-5500. 410-780-5555.
Branch/Distributors: Canada Colours &
Chemicals, Don Mills, ON;

Marson Canada Inc. 7 Ingram Drive.,
Toronto ON, M6M 2L8. 416-248-0115.

Master Builders 3637 Weston Road.,
Weston ON, M9L 1W1. 416-741-3830.

Branch/Distributors:
Dartmouth, NS; Montreal, PQ; Winnipeg, MB;

Saskatoon, SK; Edmonton, AB; Vancouver

Masdom 83 Sunrise Ave., Toronto ON,
M4A 1B1. 416-751-2380. Branch/
Distributors: Representatives in major
cities.

Mask-Off PO Box 1148/345 W Maple.,
Monrovia CA, 91016. 818-359-3261.

Mathews Conveyor P.O. Box 30., Port
Hope ON, L1A 3W1. 416-885-2491.

Branch/Distributors: St. Laurent, PQ;
Burlington, Pickering, ON; Vancouver,

Matthews 5051 North Service Road.,
Burlington ON, L8N 3G2. 416-336-1100.
Branch/Distributors: Thos. W. MacKay,
Vancouver, BC; Eastern Paper, Saint John,

Mattson Spray Equipment Inc. 230 West
Coleman, Rice Lake, WI USA, 54868.
715-234-1617. 715-234-6967.

Maxitrol Company P.O. Box 2230,
Southfield, MI, 48037. 313-356-1400.
313-356-0829.

Max Marx Color Co., 1200 Grove St.,
Irvington, NJ USA, 07111. 201-373-7801.
201-373-9301.

Maxon Industrial Equipment 969 Derry
Road East, Mississauga, ON, L5T 2J7.
905-795-0717. 905-795-1819. Branch/
Distributors: Western Combustion
Services, Regina & Saskatoon, SK; Western
Air & Gas, Vancouver, BC; Combustion
Maxtherm Inc., Montreal, PQ; Control
Tech. Meas. Sys., Calgary & Edmonton,
AB;

MBA Manufacturing & Supply Co. 1248
Allanson Rd., Mundelein, IL USA, 60060.
708-566-2555. 708-566-2561.

MBA Manufacturing 1248 Allanson Rd.,
Mundelein, IL 60060. 708-566-2555.
708-566-2561.

McCarthy Robinson Engineering Inc.
205 Riviera Dr. Unit #5, Markham, ON,
L3R 5J8. 905-415-1799. 905-415-1790.
Branch/Distributors: MRI Sales, Calgary,
AB. P.J. Hannah Equip., Burnaby, BC; Ken
Atkinson, Waterdown, ON; Michael
Salerno, St. Leonard, PQ;

McCorquodale Color Card 30 Tempo
Ave., Willowdale ON, M2H 2N8.
416-499-1946. 416-499-9365. Branch/
Distributors: Superior Sample Card,
Longueuil, PQ

The Mearl Corporation 41 East 42nd
Street., New York NY 10017.
212-573-8500. 212-557-0742. Branch/
Distributors: St. Lawrence Chemical Co.
Ltd., Montreal, PQ; Rexdale, ON. Enchem
Sales Ltd., North Vancouver, BC;

Meco 445 Bryant Blvd., Rock Hill, SC,
29732. 803-366-8316.

Meflag Filtration P.O. Box 507,
Stoughton, MA, 02072. 617-344-1700.

Melamine Chemicals Inc., River Road
Hwy. 18., Donaldsonville, LA, 70346.
504-473-3121. 504-473-0550.

Metalone 6550 Lawrence Avenue East,
West Hill ON, M1E 4R5. 416-282-1107.
Distributors: Frank T. Ross & Sons, West
Hill, ON; P. Wong & Assoc., Vancouver,
BC; Norm Collin & Assoc., Calgary, AB;
S. Strome & Assoc., Winnipeg, MB. J.P.
Fontigny Inc., Montreal, PQ;

Metalco & Eddy 30 Harvard Mill Square,
Wakefield, MA USA, 01880.
617-246-5200. 617-245-6293. Branch/
Distributors: Richmond Hill, ON

Metco Canada #9-7956 Torbram Road.,
Brampton, ON, L6T 5A2. 905-458-1333.
905-458-1611. Branch/Distributors:
Calgary, AB; Montreal, PQ; Vancouver,
BC; Winnipeg, MB; Edmonton,
AB; Ottawa,

Metal Samples Co. Inc. 152 Metal
Samples Road, Munford, AL USA, 36268.
205-358-4202. 205-358-4515.

Meyer Service & Supply Ltd. 119 Warner
Drive R.R. 1, Long Sault, ON, K0C 1P0.
613-938-2185. 613-933-8726.

MG Chemicals 9347 - 193 Street., Surrey
BC, V3T 4W2. 604-888-3084. Branch/
Distributors: Brampton, ON;

Micro Abrasives P.O. Box 669., Westfield
MA USA, 01086. 413-562-3641.
413-562-7409. Branch/Distributors:
Mafer Inc., Montreal, PQ; Spectrum
Abrasives Ltd., Rexdale, ON

Mico Distributors Inc. 6291 Dorman Rd.
Unit 17, Mississauga, ON, L4V 1H2.
905-673-1288. 905-673-1134.

Microcolor Dispersions 333 Homer
Avenue., Toronto ON, M8W 1Z6.
416-252-5676. Branch/Distributors:
Cascade Marketing, Vancouver, BC

Michelman Inc. 9080 Shell Rd.,
Cincinnati, OH USA, 45236.
513-793-7766. 513-793-2504.

Michigan Chrome 8615 Grinnell Avenue,
Detroit, MI, 48213. 313-267-5200.

Micro Powders Inc. 580 White Plains Rd.,
Tarrytown, NY, 10591. 914-793-4058.
914-472-7098. Branch/Distributors: A.S.
Paerson Co. Ltd., North York, ON;

Mid West Abrasive Box 147-620 Albert
St., Strathroy ON, N7G 3J1.
519-245-2941. Branch/Distributors: Vary
Abrasives, Richmond Hill, ON

Midwest Air P.O. Box 188., Owosso, MI,
48867. 517-723-8881. 517-725-2031.

Mighty Lube 9569 West 40th, Freemont,
MI USA, 49412. 616-924-6160.
616-924-6810. Branch/Distributors: ML
Technologies International, Mississauga,
ON; 416-670-0763.

Milbank Systems Inc. 5601 Gardner Ave.,
Kansas City, MO USA., 816-241-9450.
816-241-9117.

Milton Can Co. P.O. Box 1100 580 Div. St.
Elizabeth, NJ, 07201. 908-289-8100.
908-355-2397. Branch/Distributors: Nan
Ind. Prod., Laval, PQ; Stochem Inc.,
Lachine, PQ; & Brampton, ON;

Miles Canada Inc. Chemicals Div. 77
Belfield Road, Etobicoke, ON, M9W 1G6.
416-248-5544. 416-248-4496. Branch/
Distributors: Montreal, PQ; Vancouver,
Miller-Williams Hydronics Ltd. 4060
Fairview St./Unit 12, Burlington ON, L7L
4Y8. 905-637-9496. 905-333-5446.
Branch/Distributors: Toronto:
416-868-1550

Miller Thermal Inc. 555 Communication
Drive, Appleton WI, 54915. 414-731-6884.
414-734-2160.

Millipore 3688 Nashua Drive,
Mississauga, ON, L4V 1M5.
416-678-2161. 416-678-0882. Branch/
Distributors: Montreal, PQ;

Minolta 369 Britania Road East,
Mississauga, ON, L4Z 2H5. 416-890-6600.
Branch/Distributors: Industrial-Lab
Instrument, Ancaster, ON; Horizon
Chemicals, Richmond, BC;

Mineral Pigments 12116 Conway Road.,
Beltsville MD, 20705. 301-210-2400.
Branch/Distributors: L. V. Lomas
Chemical, Mississauga, ON; Dorval, PQ

Minifibers 2923 Boones Creek Rd.,
Johnson City TN USA, 37615.
615-282-4242. Branch/Distributors: R.M.
Ferguson Co., Brampton, ON;

Minolta Canada Inc. 369 Britannia Road
East, Mississauga, ON, L4Z 2H5.
416-890-6600. 416-890-7199.

Mississipi 7 Alby Street, Alton, IL,
620022247. 618-465-7741. Branch/
Distributors: Debro Chemicals,
Mississauga, ON; Dorval, PQ; Vancouver,
Mitech 1780 Enterprise Pkwy., Twinsburg,
OH, 440872204. 216-425-1634.
216-425-9254.

Mixmor 801 Third Avenue, King of
Prussia, PA, 19406. 215-337-2700.
215-354-0937. Branch/Distributors:
Affiliated Engineering, Scarborough, ON;
& Lachine, PQ;

Monsanto Canada Inc. 2330 Argenta
Rd., Mississauga ON, L5M 2G4.
905-826-9222. 905-826-3119. Branch/
Distributors: Lasalle, PQ; Abbotsford, BC;
A.R. Monteith (77) Limited 2615
Wharton Glen Avenue., Mississauga ON,
L4X 2B1. 905-270-0311. 905-270-0160.
Moody SI (1986) Ltd. 251 St. Louis
Street., Terrebonne PQ, J6W 1H5.
514-471-3711. 514-471-1553.

Morton International 3 Box East Constitution
Dr., Bordenown, NJ USA, 08505.
609-298-6020.

Morton International 2700 East 170th
Street., Lansing IL, 60438. 708-474-7000.
Branch/Distributors: Morton Intl., Ajax,
Ontario;

Morse Mfg. Co. Inc. Box 518-CMBG.,
East Syracuse NY, 13057. 315-437-8475.
315-437-1029. Branch/Distributors:
Safety Supply Co., Richmond Hill, ON;
Teaniquip Ltd., Lachine, PQ; Mississauga,
ON and Ste-Anne-de-Bellevue, PQ;
Motivation Ind. Eq. Ltd., Stoney Creek,
ON; Western Industrial Distributors, North
Vancouver, BC;

Morton P.O. Box 15240., Reading PA,
19565. 215-775-6600. 215-775-6691.

R.F. Mote 214 Newkirk Road., Richmond
Hill ON, L4C 3G7. 905-884-5250.

Mountain Minerals Co. Ltd. P.O. Box
700., Lethbridge, AB, T1J 3Z6.
403-329-0443. 403-328-9110. Branch/
Distributors: L. V. Lomas Ltd., Brampton,
ON; Dorval, PQ; New Westminster, BC.

M&T Harshaw 1180 Corporate Drive,
Burlington, ON, L7L 8R6. 416-332-0111.
416-332-0841. Branch/Distributors:
Empire Buff Co., Saint-Vincent De Paul,
Laval, PQ;

Mocap Inc. 10964 Lin. Valle Dr., St. Louis,
MO USA, 63123. 314-845-3100.
314-487-8855.

MultiChem Inc. 1205 Ampere Street #305,
Boucherville, PQ, J4B 7M6.
514-449-6363. 514-449-5280. Branch/
Distributors: Whitby, ON;

Multiplex Chemicals Ltd. 1903 Margaret
Street., London ON, N5W 2J9.
519-451-1720. 519-451-1903. Branch/
Distributors: Multispray Packaging &
Mfg., Mississauga, ON;

Multiquip Ltd. 2538 Speers Road Unit 2,
Oakville, ON, L6L 5K9. 905-825-0134.
905-825-2919.

Munters Zeol 79 Monroe Street,
Amesbury, MA, 01913. 508-388-2666.
508-388-0292. N.R. Murphy Ltd. 430
Franklin Blvd., Cambridge ON, N1R 8G6.
519-621-6210. 519-621-2841. Branch/
Distributors: Energy Technology,
Edmonton, Calgary, Burnaby, Saskatoon;
Ashtech Engineered Products Co., New
Brunswick, P.E.I., Nfld., Nova Scotia;

Myers Engineering 8376 Salt Lake
Avenue, Bell CA USA, 90201.
213-560-4723. Branch/Distributors: The
Source Canadian Distributors Inc., North
York, ON

N

Nacan Products Ltd. 60 West Drive.,
Brampton ON, L6T 4W7. 416-454-4466.
416-454-5207. Branch/Distributors:
Boucherville, PQ; Surrey, BC;

Nampac 165 Wycroft Road., Oakville
ON, L6K 3N8. 416-842-1473.
416-842-0116. Branch/Distributors:
Edmonton, AB; New Westminster, BC

National General Filter Prod. Ltd. 100
Rutherford Road South, Brampton ON,
L6W 3J5. 905-459-6409. 905-459-0096.
Branch/Distributors: Calgary, AB;
Richmond, BC; Saskatoon, SK; St.
Laurent, PQ; Winnipeg, MB; Richmond,
BC

National Chemical Company Inc. 600
West 52nd Street, Chicago, IL USA, 60609.
312-924-3700.

National Silicates Limited 429 Kipling
Avenue, Etobicoke, ON, M8Z 5C7.
416-255-7771. 416-255-1770. Branch/
Distributors: Valleyfield, PQ; Surrey, BC;
Whitecourt, AB; Parksville, BC; Toronto,
ON; Canada Colors & Chemicals Ltd.;
Van Waters & Rogers Co. Ltd.,

Netsch Incorporated 119 Pickering Way.,
Exton PA, 19341 1393. 215-363-8010.
215-363-0971. Branch/Distributors: L.V.
Lomas Limited, Brampton, ON;

Neupak 11935 Portland Avenue,
Burnsville, MN, 55337. 612-894-0229.

Neville 2800 Neville Road, Pittsburgh, PA
USA. 15225 1496. 412-331-4200. Branch/
Distributors: Tartan Color & Chemical,
Mississauga, ON;

New London 1700 Division Street., New
London WI, 54961. 414-982-4030.

Newpac USA P.O. Box 1461, Palatine, IL
USA. 60078. 708-541-3961.
708-541-3247.

Newport Scientific 8246 East Sandy Ct.,
Jessup MD USA. 207940189.
301-498-6700. Branch/Distributors:
Finnan Engineered Products, Scarborough,
ON

New Way Packaging Bletner Avenue.,
Hanover PA, 17331. 717-637-2133.
Branch/Distributors: Chisholm Machinery
Sales, Niagara Falls, ON; Thos. W. Mackay
& Son, Vancouver, BC

Newark Wire Cloth 351 Verona Avenue.,
Newark NJ USA, 07104. 201-483-7700.
201-483-6315.

Niagara Paint 2 Hillyard St/PO Box 402.,
Hamilton ON, L8L 7W4. 416-522-4604.

NLB 29830 Beck Road., Wixom MI USA,
483932824. 313-624-5555. 313-624-0908.
Noramco Inc. 410 George Street, New
Brunswick, NJ USA, 089012021.
908-524-1954. 908-524-1947.

Nordson Canada Limited 1211 Denison
Street., Markham, ON, L3R 4B3.
416-475-6730. 416-475-8821. Branch/
Distributors: Nordson Canada, St. Laurent,
PQ; Sterling Equip., Winnipeg, MB;
Malcolm Campbell & Sons, Vancouver,
BC;

Norspec Controls Ltd. 272 St. Andrew St.,
Samia, ON, N7T 2L4. 519-332-2433.
519-332-4707.

North American Design 7 Moonstream
Court, Mississauga, ON, L5N 2P8.
416-567-4404.

Northern Paint Canada Inc. P.O. Box 219
Station c., Winnipeg MB, R3M 3S8.
204-475-9400. 204-453-6731. Branch/
Distributors: Calgary, Edmonton, Regina.

Norspec Ind. Filters 272 St. Andrews
Street, Samia, ON, N7T 2L4.
519-332-2433. 519-332-4707.

Northumberland Paints P.O. Box 2620.,
Charlottetown PEI, C1A 8C3.
902-566-2622. 902-628-8733.

Novamax Technologies (Canada) Inc.
3-2666 Royal Windsor Dr., Mississauga
ON, L5J 4N1. 905-855-1616.
905-822-3935. Branch/Distributors:
Lachine, PQ; Winnipeg, MB; Calgary,
AB; Vancouver, BC;

Novapro Equipment Ltd. 2720 Rena
Road, Mississauga, ON, L4T 3J9.
905-672-9116. 905-672-9047.

Nutro Machinery 11515 Alameda Dr.,
Strongsville, OH USA, 44136.
216-572-3800. Branch/Distributors:
Strongsville, Ohio

NYCO Minerals Inc. 124 Mountain View
Drive., Willsboro, NY USA, 12996.
518-963-4262. 518-963-4187. Branch/
Distributors: Stochem Inc., Brampton, ON;
Lachine, PQ;

O

Oakite 115 East Drive., Bramalea ON, L6T
1B7. 416-791-1628. Branch/Distributors:
Reg. H.Q.: Toronto, ON; Calgary, AB;
Montreal, PQ

Oakside 97 White Oak Road., London ON,
N6E 1L8. 519-681-1103. 519-681-4263.

O'Brien 5300 Sunrise, Houston, TX USA.
77021. 713-641-0661.
Branch/Distributors: Cloverdale
Paint-Distributor

Omega Recycling Systems 5524 Ferrier
Street, Montreal, PQ, H4P 1M2.
514-737-0551. 514-731-1684.

OM Group Inc. 2301 Scranton Road.,
Cleveland OH USA, 44113.
216-781-8383. Branch/Distributors:

Tartan Color & Chemical, Mississauga ON

Omya Inc. 61 Main Street., Proctor VT
USA, 05765. 802-459-3311.
802-459-2125. Branch/Distributors:
Toronto, ON, Montreal, PQ St. Lawrence
Chemicals

Ontemp 17 Belfield Rd., Rexdale ON,
M9W 1E8. 416-241-7282. 416-241-7877.

Ontor Limited 12 Leswyn Road., Toronto
ON, M6A 1K3. 416-781-5286. Branch/
Distributors: Montreal, Edmonton, Calgary,
Vancouver, Moncton,

Orr & Boss Ste. 202 1323 Exmouth Str.,
Samia ON, N7S 3Y1. 519-542-1415.
519-542-1371.

Ortech 2395 Speakman Drive.,
Mississauga ON, L5K 1B3. 905-822-4111.
905-823-1446.

Osborn Manufacturing 5401 Hamilton
Avenue., Cleveland OH, 44144.
216-361-1900. 216-361-1913. Branch/
Distributors: Vancouver, Calgary,
Edmonton, Saskatoon, Thunder Bay,
Windsor, Ottawa, Montreal, Sept. Iles, Trois
Rivieres, Learnington, London, Samia,
Mississauga, Regina, Wallaceburg,
Winnipeg, Chetwynd, Fort St. John, Arvida
Jonquiere, Rexdale, St. Laurent, Montreal,
Newcastle, St. Laurent;

OSI Specialties Canada Inc. 1210
Sheppard Ave. East, Willowdale, ON, M2K
1E3. 416-490-0466. 416-490-0051.

Osmonks 5951 Clearwater Drive.,
Minnetonka, MN, 553438990.
612-933-2277. 612-933-0141. Branch/
Distributors: Duf-Pro Ltd., Brossard, PQ;
Drake Continuous Water, Burlington, ON;

P

PQ Corp. P.O. Box 2248., Chantanooga
TN, 37409. 615-629-7160. 615-698-0614.

Paasche Airbrush Co. 7440 W. Lawrence
Avenue., Harwood, Heights, IL USA,
606563497. 708-867-9191. 708-867-9198.
Branch/Distributors: Universal Air
Equipment, Scarborough, ON;

Pacline Overhead Conveyor Corp. 10
Falconer Drive, Mississauga ON, L5N 3L8.
416-858-2330. 416-858-2333. Branch/
Distributors: Pacline Limitee, Montreal,
Quebec.

Pacific Micro Software Engineering 1500
Pacific Coast Hwy. #E, Seal Beach, CA
USA, 90740. 310-799-8888.

310-799-8833. Branch/Distributors:
Anchor Consultants, Concord, ON;
Bragonier & Assoc., Toronto, ON;
Westwood and Best, Etobicoke, ON;
Platinum Canada, Mississauga, ON.

Paintronic 332 Nantucket Blvd.,
Scarborough, ON M1P 2P4 (416)
750-3292.

Pall (Canada) Ltd. 7205 Millcreek Drive.,
Mississauga ON, L5N 3R3. 905-542-0330.
Branch/Distributors: Montreal, PQ

Palmer Instruments 234 Weaverly
Hwy., Asheville, NC USA, 28804.

704-658-3131. Branch/Distributors:
Can-Tronics, Hamilton, ON; RDC Control,
Blainville, PQ; Elisar Enr., Clearwater, ON

PAP Engineering Services 34 Jasmine
Road., Weston ON, M9M 2P9.
416-743-9601. 416-745-3655.

Park Thermal Canada Limited 62 Todd
Road., Georgetown ON, L7G 4R7.
905-877-5254. 905-877-6205.

Parker & Amchem 165 Rexdale Blvd.,
Toronto ON, M9W 1P7. 416-743-8811.
416-745-8085.

Parkson Corporation 2727 NW 62, Fort
Lauderdale, FL, 33309. 305-974-6610.
Branch/Distributors: Parkson, Dorval, PQ;

A.S. Paterson Company Limited 1110 Sheppard Ave E/W404., North York ON, M2K 2W2. 416-222-3333. 416-222-5034.

Patterson Industries (Canada) Limited 250 Danforth Road., Scarborough ON, M1L 3X4. 416-694-3381. 416-691-2768.

Paul O. Abbe Inc. 139 Center Avenue., Little Falls NJ USA, 07424. 201-256-4242. 201-256-0041. Branch/Distributors: Separator Engineering Ltd., Pointe Claire, PQ; 514-694-4440.

Paul N. Gardner 316 Northeast First St., Pompano Beach FL USA, 33060. 305-946-9454. Branch/Distributors: Cascade Chemical Commodities, Vancouver, BC; Islington, ON

Paul Mueller Company 1600 W. Phelps P.O. Box 828, Springfield, MO, 65801. 417-831-3000. 417-831-3528.

Pavco 8100 Grand Avenue, Cleveland, OH, 44104. 216-231-5600. Branch/Distributors: Parfield Enterprises, Brampton, ON; 416-457-7597

PCF Group 100 Wellington Drive., Stamford, CT USA, 06903. 203-329-8588. 203-329-8876. Branch/Distributors: To Be Announced January 1st, 1991

Peacock Inc. 1158 Aerowood Drive., Mississauga ON, L4W 1Y5. 905-625-7100. 905-625-7203. Branch/Distributors: Montreal; Calgary; Edmonton; Vancouver; Halifax; Toronto;

Peintures Prolux 11430 56 Avenue., Montreal PQ, H1E 2L5. 514-648-4911.

Penn Color 400 Old Dublin Pike., Doylestown PA, 18901. 215-345-6550. Branch/Distributors: St. Lawrence Chemical Co. Ltd Montreal, PQ

Permalux Inc. 11430 56 Avenue., Montreal, Quebec, H1E 2L5. 514-648-4911. 514-648-4060.

Permarshell Coating Services Ltd. 5732 Highway 7 Unit 21, Woodbridge, ON, L4L 3A2. 905-850-1250. 905-850-1252.

Performance Paints 328 Carlingview Drive, Rexdale, ON, M9W 5G5. 416-675-9090.

William R. Perrin 432 Monarch Avenue., Ajax ON, L1S 2G7. 416-683-9400. Branch/Distributors: Southgate Equipment Ltd., St. Anne de Bellevue, PQ Mequipo Sales Ltd., Vancouver, BC T.D. Rooke Associates Ltd., Toronto, ON

Petro Canada 1 Place Ville Marie 18 Fl, Montreal, PQ, H3B 4A9. 514-878-7200. 514-878-7041. Branch/Distributors: Montreal, PQ

Pen Kem Inc. 341 Adams St., Bedford Hills, NY USA, 10507. 914-241-4777. 914-241-4842.

Phillips Paint Products Ltd. 95 Paquin Road., Winnipeg MB, R2J 3V9. 204-661-6781. 204-663-9228. Branch/Distributors: Royal City Paint, Guelph, ON; A.R. Monteith Ltd., Mississauga, ON; Thunder Bay Paint Supplies, Thunder Bay, ON; Heer's Dec. & Design, Kitchener, ON; Western Paint, Winnipeg, MB; RKR Coatings Ltd., Winnipeg, MB; Bellare

Coatings Inc., Calgary, AB; Western Paint Supply, Edmonton, AB; Ken Nash Paint & Wallpaper, Welland, ON; The Colour Shoppe, Brantford, ON; Paint Shop of Canada, Surrey, BC;

Pierce & Stevens 224 Catherine St Box 249., Fort Erie ON, L2A 5M9. 905-871-2724. 905-871-5455.

Plasmag Pump 2 Hillview Dr./Dept. CM, Lake Barrington IL, 60010. 312-381-8180.

Plasti-Kote Inc. 7655 Trannere Drive., Mississauga, ON, L5S 1L4. 905-671-8333. 905-671-0890. Branch/Distributors: Canadian Trade Corporation, Mississauga, ON;

Plas-Weld 923 Matheson Blvd., Mississauga, ON, L4W 2R7. 416-238-9393. 416-238-9432.

Pneumafill Corporation 5301 Terminal Street, Charlotte, NC, 282978804. 704-399-7441. 704-398-1533.

Pocono Fabricators P.O. Box 458., East Stroudsburg PA USA, 18301.

717-421-7500. Branch/Distributors: Chase Masonry, NS; Plitbrico (Canada) Ltd., Calgary & Edmonton, AB; Winnipeg, MB; Vancouver, BC; Bigelow-Liptak of Canada Ltd., Mississauga, ON; Eastcoast Industries Ltd., NF

Pollution Control 2677 Freewood Drive., Dallas TX, 75220. 214-358-1539. Branch/Distributors: ProQuip Consultants, North York, ON

Poly Products Corporation P.O. Box 90068, Henderson, NV, 89015.

702-566-3000. 702-566-5678. Branch/Distributors: M&T Harshaw, Burlington, ON; MacDermid Chemicals, Mississauga, ON; Kudzu Technologies, Markham, ON;

Polymer 2120 Fairmont Avenue., Reading PA USA, 19603. 215-320-6600. Branch/Distributors: Polypenco Canada Inc. Guelph, ON

Polyquip 11-1255A Reid Street., Richmond Hill ON, L4B 1E9. 416-731-8374. Branch/Distributors: St. Laurent, PQ; Calgary, AB; Port Coquitlam, BC;

Polytex Environmental 820 East 140th Street., Bronx NY, 10454. 212-402-2000. 212-402-2984.

Potters Industries Inc. 20 Waterview Blvd., Parsippany NJ, 07054. Branch/Distributors: LaPrairie, PQ Moose Jaw, SK; Calgary, AB

Powder Coating Supply Inc., 215 Traders Blvd. E. #7., Mississauga, ON, L4Z 3K5. 905-507-0022. 905-890-2836.

Power Flame 2001 S. 21st St., Parsons, KS, 67357. 316-421-0480. Branch/Distributors: Canadian Eng'd Products, Delta, BC.

Powers Process 4540 Dixie Road/Unit C, Mississauga ON, L4W 1N2. 905-238-4855. Branch/Distributors: Omnitech Inc., Halifax; West Isle Ind., Montreal, PQ; Lobaltech., Ottawa; Conval Equip., Toronto; Bernard Methot, Montreal; ARP, Quebec, PQ; QIP, Montreal, PQ; Lobaltech, Toronto; Power & Mine,

Winnipeg, Thunder Bay, Saskatoon; Supertech Controls, Calgary; Thomas W. MacKay, Vancouver, BC; ECMS, Sudbury; Power & Mine, Saskatoon;

PPG Canada Inc. 880 Avonhead Road., Mississauga, ON, L5T 2Z5. 905-823-7100. 905-823-7618. Branch/Distributors: PPG Canada, St. Laurent, PQ.

PPG Industries Inc. Spec. Chemicals 3938 Pore Drive, Gurnee, IL, 60031. 708-244-3410. 708-244-9633. Branch/Distributors: PPG Canada Inc., Mississauga, ON; 905-848-2500.

Pratt & Lambert 254 Courtwright St., Fort Erie ON, L2A 5M9. 905-871-4913. 905-871-9160. Branch/Distributors: Montreal, Winnipeg, Halifax

Premier Mill Corp. 1 Birchmont Drive., Reading PA, 19606. 215-779-9500. 215-779-9666. Branch/Distributors: The Source, North York, ON; Erchem, Vancouver, BC; Calgary, Edmonton, AB, Winnipeg, MB

Prescott & Company (Canada) Ltd. 6375 Kestrel Road., Mississauga ON, L5T 1Z5. 905-564-8383. 905-564-8386. Branch/Distributors: Montreal, PQ; Vancouver, BC; Toronto, ON;

Prism (UK) Ltd. Friars Alley, Lichfield Staffs, England, WS13 6PW. 44543-250379. 44543-419295.

Prism Powder Coatings Ltd. 55B Buttermilk Ave., Concord, ON, L4K 3X1. 416-660-5361. 416-660-5362.

Proceco Industrial Mach. 7300 Tellier St., Montreal, PQ, H1N 3T7. 514-254-8494. 514-254-8184.

Prochem Mixing 8032 Torbram Road., Brampton ON, L6T 3T2. 416-793-6800. 416-793-9434. Branch/Distributors: Bancroft Western Sales Ltd., N. Vancouver; Chemaction Inc. St. Leonard, PQ; Atlantic Engineered Products, Riverview, NB;

Production Paint Stripping, 11A McLachlan Dr., Rexdale, ON, M9W 1E3. 416-675-1265. 416-675-6096.

Prokote Inc. 385 Dundas Street., Cambridge ON, N1R 5R1. 519-621-2992. Branch/Distributors: Prokote Plant 2, Kitchener, ON;

Promat Engineering 1049 Crawford Drive, Peterborough, ON, K9J 6X6. 705-742-9233. 705-742-9235.

Progressive Recovery Inc. 700 Industrial Drive, Duplo, IL USA, 62239. 618-865-5000. 618-286-5009.

Process Technology Inc. 7010 Lindsay Drive, Mentor, OH, 44060. 216-974-1300. 216-974-9561.

Protech Chemicals Ltd. 7600 Henri Bourassa West, St. Laurent, PQ, H4S 1W3. 514-745-0200. 514-745-5774. Branch/Distributors: Toronto, ON 416-667-9697; Greenfield Ventures, 604-535-0033;

ProQuip Consultants Inc. 611-220 Duncan Mill Road, North York, ON, M3B 3J5. 416-444-8028. 416-444-8522.

Punda Mercantile Inc. 310 Victoria Avenue., Montreal, PQ, H3Z 2M9.

514-489-7278. 514-489-6464. Branch/
Distributors: Montreal, PQ; Toronto, ON;
Vancouver, BC

Purity Zinc 290 Arvin Avenue., Stoney
Creek ON, L8E 2M1. 905-662-4802.

PW & Associates 31333 Southfield Road,
Birmingham, MI, 48009. 313-642-2600.
313-642-5452.

Pyrometer Instrument Co. Inc. 234
Industrial Parkway., Northvale NJ, 07647.
201-768-2000. 201-768-2570. Branch/
Distributors: Pyrometer Inst. Canada,
Penetanguishene, ON; 705-527-7976.

Pyronics 17700 Miles Avenue., Cleveland
OH, 44128. 216-662-8800. Branch/
Distributors: Ordan Thermal Products Ltd.,
Markham, ON Inproheat Industries,
Vancouver, BC; IncoTech Inc., Bemieres,

Pyrotite Coatings of Canada Inc. 10th Fl.
808 W. Hastings, Vancouver BC, V6C 2X4.
604-684-3088. 604-689-9738.

Q

QC Instruments 2798 Thamesgate Dr/#6.,
Mississauga ON, L4T 4E8. 905-678-9590.
Branch/Distributors: Bob Young, Pointe
Claire, PQ 514-695-1155; Paul Belanger,
Sandis, BC, 604-858-7633;

Q-Panel 26200 First Street., Cleveland
OH, 44145. 216-835-8700. 216-835-8738.
Branch/Distributors: Chemroy Chemicals
Ltd., Mississauga, ON

Quackenbush 500 E. Main St., Lake
Zurich IL USA. 60047. 312-577-2800.
Branch/Distributors: L.V. Lomas
Equipment Division;

Quadra Chemicals Ltd. 1100 Blair Road,
Burlington, ON, L7M 1K9. 905-336-9133.
905-336-9263. Branch/Distributors:
Mississauga, ON; Vancouver, BC

R

Ragogna Custom Machinery Ltd. 21
Kenview Blvd. Unit 12. Brampton, ON,
L6T 5G7. 416-793-5185. Branch/
Distributors: Westgen Industries,
416-876-2705; West Coast: Ernie Gibeault,
604-522-6945; Quebec: Robert Payene,
514-634-9118.

Ramco Equipment 32 Montgomery
Street., Hillside NJ, 07205. Branch/
Distributors: Deane & Co., Pointe Claire,
PQ

R & W Metal Fabricating & Design Inc.
R.R. #2, Burford, ON, N0E 1H0.
519-449-5382. 519-449-5048.

Rapid Engineering P.O. Box 700.,
Comstock Park MI, 493310700.
616-784-0500.

Rapid Industries 4003 Oaklawn Drive.,
Louisville, KY, 40219. 502-968-3645.

Rapid Tank Cleaning 7020 Tranmere,
Mississauga, ON, L5S 1L9. 416-672-6772.
Reade Advanced Materials Post Office
Drawer 15039., Riverside, RI, 029150039.
401-433-7000. 401-433-7001.

Recochem Inc. 850 Montee de Liesse.,
Montreal PQ, H4T 1P4. 514-341-3550.
514-341-6553. Branch/Distributors:
Brampton, ON; Port Coquitlam, BC;

Reeco Rte. 22 West, Branchburg, NJ USA,
08876. 908-685-4000. 908-685-4120.

Reichhold 4 Robert Speck Pkwy./#700,
Mississauga ON, L4Z 1S1. 416-848-5540.
Branch/Distributors: Ste. Therese, Port
Moody, Weston.

Resinall Corp. P.O. Box 8149, Stamford,
CT, 06905. 203-329-7100. 203-329-0167.
Branch/Distributors: Stochem Inc.,
Brampton, ON; Lachine, Que.

Research Products P.O. Box 1467.,
Madison WI, 53701. 608-257-8801.
Branch/Distributors: Ron Tanney,
Richmond Hill, ON

Reynolds Metals 4101 Camp Ground
Road, Louisville, KY, 40211.

Rheometrics 1 Possumtown Road.,
Piscataway NJ, 08854. 908-560-8550.
Rheox Inc. 45 Sheppard Ave. E. S206,
Willowdale, ON., 416-223-9590.
416-223-8612.

Rheox Inc. Wyckoffs Mill Road Box 700,
Hightstown, NJ USA, 08520.
609-443-2000. 609-443-2422. Branch/
Distributors: Rheox Inc., Montreal, PQ;

Rhone-Poulenc 2000 Argentinia Plaza 3 400,
Mississauga ON, L5N 1V9. 416-821-4450.
416-821-9339. Branch/Distributors:
Rhone-Poulenc Canada, St. Catharines,
ON; Mississauga, ON; Emchem Sales,
Vancouver, BC;

Ritche Supply 1036 Matheson Blvd.,
Mississauga ON, L4W 2T9. 905-625-1730.
905-625-6305.

R.M. Ferguson & Company Inc. 292
Walker Drive Unit 8, Brampton, ON, L6T
4Z1. 905-458-5553. 905-458-8101.

Robbins & Myers Canada Ltd. 8032
Torbram Road, Brampton, ON, L6T 3T2.
905-793-6800. 905-793-9434. Branch/
Distributors: Peacock Inc., Mississauga,
ON; Montreal, PQ; Edmonton, AB;
Calgary, AB; Vancouver, BC; Dartmouth,
NS; Bancroft Western Sales, Vancouver,
BC. Robbins & Myers Canada, Edmonton,
AB;

W. S. Rockwell Company Inc. 212 Eliot
Street., Fairfield CT USA, 064300280.
203-259-1621.

Rohm & Haas 2 Manse Road., West Hill
ON, M1E 3T9. 416-284-4711.
416-284-2982. Branch/Distributors: St.
Laurent, PQ Vancouver, BC

Ross Chem Inc. 303 Dale Drive., Fountain
Inn SC, 29644. 803-862-4474.
803-862-2912.

Rousseau Controls 271 Labrosse Avenue.,
Pointe Claire PQ, H9R 1A3. 514-695-1240.
514-695-6363. Branch/Distributors:
Rexdale, ON; Moncton, NB; Quebec, Que.;

Rust-Oleum (Canada) Ltd. 590 Supertest
Road., Downsview ON, M3J 2M5.
416-661-3380. 416-661-3020.

S

Sachtleben Chemie GmbH Dr. Rudolf
Sachtleben St 4, Duisburg 17, 4100.
02066-22-0. 02066-222000. Branch/
Distributors: Canada Colors & Chemicals,
Don Mills, ON;

Sadler 1845 William Street., Montreal PQ,
H3J 1R6. 514-931-4271. 514-931-4275.
Branch/Distributors: Mississauga, ON

St. Lawrence Chemical 19201 Ave Clark
Graham, Baie d'Urfe PQ, H9X 3P5.
514-457-3628. Branch/Distributors:
Rexdale, ON

Sandoz Chemicals 4000 Monroe Road,
Charlotte, NC, 28211. 704-331-7000.
Branch/Distributors: Pigments &
Additives, Mississauga, ON Dorval, PQ;

Sartomer 468 Thomas Jones Way, Exton,
PA, 19341. 215-363-4116. Branch/
Distributors: R.M. Ferguson Co.,
Brampton, ON

Schenectady 319 Comstock Road.,
Scarborough ON, M1L 2H3.
416-757-5136. 416-757-2468.

Schlumberger Industries - Meas. Div.
7275 West Credit Avenue, Mississauga,
ON, L5N 5M9. 416-858-4211.

416-858-0428. Branch/Distributors: St.
Leonard, PQ; Calgary, AB;

Schold Machine 10590 Oak Street N.E.,
St. Petersburg FL, 33716. 813-576-1147.
Branch/Distributors: Gerald Pearson,
Montreal, PQ Burnett Bros. Machinery
Co., Concord, ON

Schwartz Chemical 777 McKay Road.,
Pickering ON, L1W 3A3. 416-683-0411.
SCM Chemicals 7 St. Paul St. Ste. 1010.,
Baltimore MD, 21202. 410-783-1120.

410-783-1087. Branch/Distributors: Paul
A. Rodrigues, Milton, ON 905-876-3595.

Scott Bader Inc. 1592 Georgetown Rd.,
Hudson, OH USA, 44236. 216-342-0035.
216-528-0184. Branch/Distributors: Frank
E. Dempsey & Sons, Toronto, ON;
Emchem Sales, N. Vancouver, BC.

Sealcraft Inc. 6525 Northam Drive.,
Mississauga, ON, L4V 1J2. 905-677-3200.
905-677-3975.

Seibert Powder Coatings 11110 Berea
Rd., Cleveland, OH USA, 44102.
216-631-2002. 216-631-6211.

Semi-Bulk Systems 1812 Walton Road.,
St. Louis MO, 63114. 314-428-6655.
314-428-4568.

Semlero 15817 Crabbs Branch Way,
Rockville, MD, 20855. 301-975-9798.
301-975-9653. Branch/Distributors:
Cedco Inst. Ltd., Milton, ON, 905-876-2847;
Folio Inst., Kitchener, ON, 519-748-4612.
Mark Phillips, Hamilton, ON,
905-318-8333.

Sensorex 11661 Seabond Circle, Stanton,
CA, 90680. 714-895-4344. 714-894-4839.
Branch/Distributors: Romatec,
Willowdale, Thunder Bay, Sudbury, Sarnia,
Montreal, Rotech Controls-NS;

Servite Filtration 3291 Mainway Unit #5.,
Burlington, ON, L7M 1A6. 416-336-5278.

416-332-1223. @body I = Senif Coatings
1235 Cardiff Boulevard., Mississauga ON,
L5S 1P8. 905-564-1023.

Servair Inc. 270 Brunel Road.,
Mississauga ON, L4Z 1T5. 416-890-1855.
416-890-7090.

Shadrack Engineering (1978) Ltd. 501
Passmore Ave. Unit 13, Scarborough ON,
M1V 5G4. 416-293-3100. 416-293-2370.

Shamrock Technologies Foot of Pacific
Street., Newark NJ, 07114. 201-242-2999.
201-242-8074. Branch/Distributors:
Industrial Colours and Chemicals Ltd.
Brampton, ON

Shawflex 25 Bethridge Road., Rexdale
ON, M9W 1M7. Branch/Distributors:
Edmonton, Lachine

Shell Chemicals Canada Inc. P.O. Box
100 Stn. M. Calgary, AB, T2P 2H5.
Branch/Distributors: Montreal, PQ; Don
Mills, ON; Vancouver, BC

Sherwin Williams Chemical Coating's
130 Van Kirk Drive, Brampton, ON, L7A
1B1. 905-846-0740. 905-840-3010.

Shercon Inc. 1823 San Fernando Rd., Los
Angeles, CA USA, 90065. 213-224-1777.
213-223-5741.

Sherwin Williams Canada Inc. 66 West
Beaver Creek Rd., Richmond, ON, L4B
1G5. 905-764-6334. 905-764-6117.
Branch/Distributors: Dorval, PQ;
Winnipeg, MB; Vancouver, BC

Sherwin-Williams Chemicals 1700 W.
Fourth St., Coffeyville, KS, 67337.
316-251-7200. Branch/Distributors:
Kingsley & Keith, Etobicoke, ON;

Sico Industrial Coatings Div. 175 Rexdale
Blvd., Rexdale ON, M9W 1P8.
416-743-4200. 416-743-8231. Branch/
Distributors: Ville D'Anjou, Ville St.
Laurent, Ste. Foy, PQ; St. Catharines, PQ;

Sifco Selective 5708 Schaaf Road,
Cleveland, OH, 44131394. 216-524-0099.
216-524-6331. Branch/Distributors:
Brudac Canada, Dorval, PQ; Price &
Assoc., Ottawa, ON.

Sigma Engineering 39 Westmoreland
Avenue, White Plains NY USA, 10606.
914-682-1820.

Silberline Mfg. Co. Inc. Lincoln Drive PO
Box B, Tamaqua, PA, 18250420.
717-668-6050. 717-668-0197. Branch/
Distributors: Frank E Dempsey & Sons,
Toronto, ON Lachine, PQ; L.V. Lomas,
New Westminster, BC;

T.S. Simms P.O. Box 820., St. John NB,
E2L 4C5. 506-672-6330. 506-635-6330.
Branch/Distributors: Montreal, Toronto,
Winnipeg, Vancouver

Simpson Electric Company 853 Dundee
Ave., Elgin IL, 60120. 708-697-2260.
708-697-2272. Branch/Distributors: Bach
Simpson Ltd., London & Toronto

Singleton Corporation 3280 West 67th
Place., Cleveland OH USA, 44102.
216-651-7800. Branch/Distributors: J.B.
Atlas Company, Rexdale, ON; Burnco
Technologies, Woodlawn, ON; Canadian
Test & Control Equip., Beeton, ON;

Sioux Tools 2244 Drew Road/W3.,
Mississauga ON, L5S 1B1. 416-671-2624.

Site Remediation Inc. 1600-5468 Dundas
St. W., Etobicoke, ON, M9B 6E3.
416-234-6821. 416-234-5074. Branch/
Distributors: Calgary, AB; Montreal, PQ;

Skybryte 3125 Perkins Avenue., Cleveland
OH, 44114. 216-771-1590.

W.W. Sly 21337 Drake Road Ste. A,
Strongsville OH, 44136. 216-238-2000.
Branch/Distributors: McCarthy &
Robinson Ltd.; Scarborough, ON

Solem Division/J.M. Huber Corp. 4940
Peachtree Ind. Blvd., Norcross, GA USA,
30071. 404-441-1301. 404-368-9908.
Branch/Distributors: L.V. Lomas Ltd.,
Dorval, PQ; New Westminster, BC;
Brampton, ON;

Solomat TA Instrumentation 652
Glenbrook Road, Stamford, CT, 06906.
203-977-8161.

Solv-O 6995 Monroe., Taylor MI, 48180.
313-292-2060.

Sonic Corp. 1 Research Dr., Stratford, CT
USA, 06497. 203-375-0063.
203-378-4079. Branch/Distributors: Rep:
Sage Industrial Products, Don Mills, ON;

Sonic Star International Ltd. 4016
Promontory Drive, Mississauga, ON, L5L
3G6. 800-766-6606. 416-828-1517.

Sonoco Fibre Drum 2122 Colvin Blvd.,
Tonawanda, NY USA, 14150.
716-836-4200. 716-836-7817.

Sorbent Control 200 North Spring Street,
Elgin, IL, 60120. 708-695-2900.
708-695-2050.

Southern Clay Products Inc. 1212 Church
St. Box 44., Gonzales, TX USA, 78629.
210-672-2891. 210-672-3081. Branch/
Distributors: Stochem - Toronto,
Vancouver.

Southern Coatings - Kenco Div. Box 160.,
Sumter SC, 29151. 803-775-6351. Branch/
Distributors: Sure-Grip Ltd., Mississauga,
ON; Master Wldg. & Safety Equip.,
Sudbury, ON; Vancouver, BC; SFC
Steelfab Canada Ltd., Burnaby, BC

Specialty Tapes 1405 16th Street, Racine,
WI, 53403. 414-634-6688. 414-634-4293.

Spectra-Tech Inc. 652 Glenbrook Road.,
Stamford CT, 06906. 203-357-7055.
203-357-0609. Branch/Distributors:
Fisher Scientific, Whitby, ON; Theemo
Electronics, Mississauga, ON; Bomen,
Quebec, QC.

SpeedFlo 800 Garyray Drive., Weston ON,
M9L 1X1. 416-741-5620. 416-749-2546.

Spelmac Ltd. 12625 56th Ave. Riv. DP,
Montreal, PQ, H1E 2M5. 514-648-4914.
514-648-4916.

Spraybake Ltd. 89 Connie Cres., Concord
ON, L4K 1L3. 416-669-6548.
416-669-1171.

Spraylat 716 South Columbus Ave., Mt.
Vernon NY USA, 10550. 914-699-3030.

Spraymation 5320 N.W. 35th Avenue., Ft.
Lauderdale FL, 333096314. 305-484-9700.
Branch/Distributors: Adhesive Application
Systems Ltd., Scarborough, ON

Spring Tools 15075 South US 131 Box 625,
Schoolcraft MI, 49087. 616-679-5276.
616-679-4735.

SRS Industrial 711 Foxwood Drive.,
Oceanside, CA, 92057. 619-722-8816.
619-722-8835.

Stanchem Inc. 43 Jutland Road, Toronto,
ON, M8Z 2G6. 416-503-6867.
416-259-5333. Branch/Distributors:
Lachine, PQ; Winnipeg, MB; Dartmouth,
NS; Edmonton, AB; Vancouver, BC;
Star Systems P.O. Box 518/101 Kershaw,
Timmonsville SC, 29161. 803-346-3101.
Branch/Distributors: Chisholm Machinery
Sales Ltd., Niagara Falls, ON

Steelcote One Steelcote Square, St. Louis
MO, 63103. 314-771-8053. Branch/
Distributors: Progressive Services Ltd.,
Burnaby, BC; Coquitlam, BC; John
Chamley, 604-525-1685

Steelman Industries Inc. 2706 Hwy
135-P.O. Box 1461, Kilgore, TX USA,
75707. 903-984-3061. 903-984-1384.

Steep Rock Resources 2020 University St.
#1255, Montreal, PQ, H3A 2A5.

514-844-7135. 514-849-4057. Branch/
Distributors: L.V. Lomas: St. Lawrence;
Stelfab Niagara Limited 8594 Earl
Thomas Ave., Niagara Falls, ON, L2E 6X8.
416-356-8683. 416-356-8288.

Stephen Bader Co. Inc. Box 297/8 Charles
Street., Valley Falls NY, 12185.
518-753-4456. 518-753-4962. Branch/
Distributors: Todd Engineering Ltd.,
Cambridge, ON

Sternson Group Box 130/22 Mohawk
Street., Brantford ON, N3T 5N1.
519-759-6600. Branch/Distributors:
Toronto, Montreal, Edmonton

Stochem Inc. 106 Summerlea Road.,
Brampton ON, L6T 4X3. 905-458-6888.
905-458-0923. Branch/Distributors:
Lachine PQ; Vancouver, BC.

D.A. Stuart Inc. 43 Upon Rd.,
Scarborough, ON, M1L 2C1.
416-757-3226. 416-757-3220.

Sub Tropical Testing Service 8290 S.W.
120 Street., Miami FL, 33156.
305-233-5341. 305-233-5342.

Sun Chemical 1260 Lakeshore Rd. East.,
Mississauga, ON, L5E 3B8. 905-274-0037.
905-274-6151.

Sunchem 36 York Mills Road., North York
ON, M2P 2C5. 416-733-7326.
416-733-0040. Branch/Distributors:
Suncor Sarnia Refinery, Sarnia, ON

SWT Specialty 12014 Tecumseh,
Tecumseh, ON, N8N 1L9. 519-735-2654.
519-735-3496.

Sylvachem 1001 E Business Hwy 98.,
Panama City FL, 32401. 904-785-6700.
Branch/Distributors: L.V. Lomas
Chemical, Mississauga, ON

Syncoat Chemicals Limited 1914
Manaw Ave., Mississauga, ON, L4X
1K1. 905-270-2391. 905-270-2639.

Syn-Tex Bag 90 Sutherland Ave.,
Winnipeg, MB, R2W 3C7. 204-947-0243.
204-947-1786.

Systech Environmental Corp. 245 N. Valley Road, Xenia, OH USA, 45385. 513-372-8077. 513-374-4133. Branch/Distributors: St. Constant, PQ; 514-635-1275: Brookfield, NS; 902-673-2991.

Systematics 26 Burnside Street, Bristol, RI, 02809. 401-253-0050. 401-253-1602.

T

Taikisha 5925 Airport Road, Mississauga, ON, L4V 1W1. 416-672-5571.

Talco Metals 389 West Elm Street, Pembroke, MA USA, 02359. 617-826-0012. 617-826-9834. Branch/Distributors: American Iron & Metals, Dorval, PQ; East Montreal, PQ.

Tartan Color & Chemical Inc. 7145 West Credit Ave #101, Mississauga ON, L5N 6J7. 905-821-2851. 905-821-7919.

Taylor Stiles Div. Littleford Day Inc. 7451 Empire Drive., Florence, KY USA, 41042. 606-525-7600. 606-525-1446.

Technical Barrier Systems Inc. 151 Randall Street, Oakville, ON, L6J 1P5. 905-842-9488. 905-842-1582.

Technical Coatings Co. Ltd. 1164 Walkers Line., Burlington ON, L7M 1V2. 905-338-4807. Branch/Distributors: Montreal.

Technic Inc. 1 Spectacle Street, Cranston, RI, 02910. 401-781-6100. 401-781-2890. Branch/Distributors: Brudac Canada Inc., Dorval, PQ.

Tek-Mor Incorporated 521 Piercy Road, Bolton, ON, L7E 5B5. 416-857-6415. 416-857-5514.

Teledyne Spec. Equip. Co., Readco Prod. P.O. Box 15552, York PA USA, 17405. 800-395-4959. Branch: Pointe Claire, PQ.

Tellkamp Systems 15520 Comet Avenue, Santa Fe Springs, CA, 90670. 310-802-1621.

Temuss Products Canada Limited 405 Mackenzie Avenue., Ajax ON, L1S 2G2. 905-683-4880. 905-683-8744. Branch/Distributors: A.S. Paterson Co., Toronto, ON Debro Inc., Brampton, ON Montreal, PQ Richmond, BC.

Tem Tech A Member Samuel Manu-Tech Group 1545 Britannia Road #35, Mississauga, ON, L4W 3C6. 416-795-0349. 416-795-0350.

Testing Machines 6 Ronald Drive., Montreal PQ, H4X 1M8.

Texaco Chemical Canada 150 Research Lane #307, Guelph, ON, N1G 2T2. 519-824-3280. 519-824-0755.

Thermal Engineering Corp. P.O. Box 868, Columbia, SC USA, 29210. 803-783-0750. 803-783-0756.

Thermal Innovations 2516 Highway 35, Manasquan, NJ USA, 08736. 908-223-1812.

Therica Inc. 900 Clancy Ave. N., Grand Rapids, MI USA, . 616-458-1538. 616-458-7120. Branch/Distributors: Servair Inc., Mississauga, ON;

Thompson-Chemtrex 921 Greengarden Road., Erie, PA, 16501 1591.

814-452-3185. Branch/Distributors: Dynesco Equipment Sales, Toronto, ON Tibbetts Paints Ltd., Glass Street, Trenton, NS, B0K 1X0. 902-752-8301.

Tiger Drylac Canada Inc. 110 Southgate Drive, Guelph, ON, N1G 4P5. 519-766-4781. 519-766-4787.

Toxide 9999 Cavendish Blvd., Ville St. Laurent, P.Q., H4M 2X5. 514-748-4304. Branch/Distributors: Toronto, Vancouver **Torrid Oven Limited** 7500 Bath Road., Mississauga ON, L4T 1L2. 905-678-2200. 905-678-6258.

Trell Services 266 Rutherford Road South, Brampton ON, L6W 3N3. 905-454-1331.

Tremco 220 Wicksteed Avenue., Toronto ON, M4H 1G7. 416-421-3300. Branch/Distributors: Edmonton, AB; Boucherville, PQ; Calgary, AB; Ottawa, ON; Halifax, NS; Vancouver, BC; Winnipeg, MB.

H.O. Trelice 1935 Huron Church Road., Windsor ON, N9C 2L6. 519-966-5666. Branch/Distributors: Mississauga, ON.

Tri-Canada Industries Inc. 7033 Telford Way., Mississauga, ON, L5S 1V4. 905-677-9000. 905-677-4988.

Tri Lite Inc. 1335 W. Randolph Street., Chicago IL USA, 60607. 312-226-7778. 312-226-5335. Branch/Distributors: Dock Specialties & Equip., Scarborough, ON, 416-789-4181.

Tristar Coatings Div. 18 Cadena Road, Brampton, ON, L6T 3Z8. 416-794-1100. 416-794-0304.

Trivalent Data Systems Limited 65 Intl. Blvd. Suite 205., Mississauga, ON, M9W 6L9. 905-674-0222. 905-674-8694.

Troy Chemical Co. Ltd. P.O. Box 301 Stn. D, Scarborough, ON, M1R 5B8. 416-287-9116. 416-287-9779. Branch/Distributors: Lacine, PQ; Cascade Mktg., Vancouver, BC;

U

Uehling Instrument 473 Getty Avenue., Paterson NJ, 07503. 201-742-8710. Branch/Distributors: Bestobell Canada Ltd., Toronto, ON.

UFS Corporation 330 N. County Rd. 400 E., Valparaiso, IN, 46383. 219-464-2027. 219-464-8646.

Ultra Additives 460 Straight Street., Paterson NJ, 07501. 201-279-1306. Branch/Distributors: Frank E. Dempsey & Sons, Toronto, ON.

Ultramatic Equipment 848 Westgate Drive., Addison IL, 60101. 312-543-4565. Branch/Distributors: Aimark Travers, Markham, ON.

Union Camp 1600 Valley Road., Wayne NJ, 07470. 201-628-2000. 201-628-2840. Branch/Distributors: St. Lawrence Chemical, Montreal, PQ; Rexdale, ON.

Union Carbide Chemicals & Plastics Inc. 1210 Sheppard Ave. E #210, North York, ON, M2K 1E3. 416-490-0052.

416-490-0051. Branch/Distributors: Willowdale, ON; Montreal East, PQ; Calgary, AB.

Unimin Specialty Minerals Inc. Route 127 P. O. Box 33., Elco, IL USA, 62929. 800-743-1519. Branch/Distributors: Debro Chemicals, Brampton, ON; Dorval, PQ; L. V. Lomas Ltd., Dorval, PQ; Brampton, ON, New Westminster, BC; Mackenzie & Feimann Ltd., Winnipeg, MB;

Union Process Inc. 1925 Akron-Peninsula Rd., Akron OH, 44313. 216-929-3333. 216-929-3034. Branch/Distributors: Firing Industries Ltd., St. Catharines, ON.

Unisource Canada Inc. 6525 Northwest Drive., Mississauga ON, L4V 1K3. 905-678-2210. 905-677-9225. Branch/Distributors: Branch locations are in all major cities from coast to coast.

Uni-Spray Nozzles Inc. 611 Conrad Place., Waterloo ON, N2V 1C4. 519-885-4270. 519-885-4325.

United Air Specialists Inc. 4440 Creek Road., Cincinnati OH, 45242.

513-891-0400. 513-891-4882. Branch/Distributors: Northstream Ind., Concord, ON; Waterloo Air Spec., Ont.; Atlantic Air Cleaning, Rothesay, NB; General Equipment, Vancouver, BC;

United Air Specialists-Kleentek 4440 Creek Road., Cincinnati OH, 45242. 513-891-0400. Branch/Distributors: Northstream Industries, Concord, ON;

United Catalysts P.O. Box 32370., Louisville KY, 40232. 502-634-7502. Branch/Distributors: Henley Chemicals Ltd., Toronto, ON; Henley Chemicals, Vancouver, BC.

United Coatings 19011 E Cataldo., Greenacres WA, 99016. 509-926-7143. 509-928-1116. Branch/Distributors: DRE Industries, Toronto, ON; Cloverdale Paint Stores, BC & AB; Duraseal Bldg. Spec., Calgary, AB; Wallace Construction Specialties, Regina, Saskatoon, SK; Cloverdale Paint Inc., Burnaby, BC; Edmonton, Calgary, AB; Barron Distributors, Winnipeg, MB; & Thunder Bay, ON.

United Electric 5320 Bracdo Blvd., Mississauga ON, L4W 1G7. 416-625-5082. Branch/Distributors: Barber Engineering & Controls, Calgary. Edmonton, AB; B.G. Controls Ltd., Port C oquitlam, BC; Flotech Controls, Regina, SK; Brian Controls, Winnipeg, MB New Brunswick, Halifax, NS; Mississauga, Samia, ON; Montreal, Quebec, PQ; Franklin Playford Inc., Ottawa, ON; Montreal, PQ.

United Mineral 1100 Valley Brook Ave., Lyndhurst, NJ, 070713608. 201-507-3300. 201-507-1506.

Universal Air 90 Minuk Acres., Scarborough ON, M1E 4X6. 416-284-4188.

UPA Technology 1 Terminal Drive, Plainview NY USA, 11803. 516-349-8300. Branch/Distributors: Rayonics Scientific Inc., Downsview, ON; Quebec;

U.S. Borax 3075 Wilshire Blvd., Los Angeles, CA, 90010. 213-251-5464. 213-251-5455. Branch/Distributors: CCC Ltd., Don Mills, ON;
U.S. Silica P.O. Box 187, Berkeley Springs, WV, 25411. 304-258-2500. 304-258-8295.
United States Testing Co. 1415 Park Avenue., Hoboken NJ, 07030. 201-792-2400. 201-792-1201.

V

Vac-U-Max 37 Rutgers Street., Belleville NJ USA, 07109. 201-759-4400. 201-759-6449. Branch/Distributors: Tes-Tech Engineered Systems, Vancouver, BC; Shadrack Engineering Ltd., Scarborough, ON SH Con-V-Air Inc., Canidac, PQ.

Valpar 645 Coronation Drive., West Hill ON, M1E 4R6. 416-284-1681. Branch/Distributors: Branches: Montreal, PQ; Calgary, AB: Distributors: J.W. Bird & Co., Fredericton, Halifax, Saint John; Guy Trembley Ltd., Chicoutimi; Downing Products Ltd., Mississauga; Inter-City Paints & Supply, Toronto; Industrial Paints & Supplies, Samia; Hugh J. O'Neil Co., Timmins; Para Paints, London; Reids Ind. Sales, Belleville; W.E. Saunders & Sons; Delhi; Wilkinson & Kompass Ltd., Hamilton;

Valvoline International 905 Winston Churchill Blv, Mississauga ON, L5J 4P2. 905-823-4701. 905-823-3843. Branch/Distributors: Boucherville, PQ;

Vanchem 4387 Corporate Drive., Burlington ON, L7L 5T9. 416-336-1445.

Vanaire 10151 Bunsen Way, Louisville, KY, 40299. 502-491-3553.

R.T. Vanderbilt I Eva Road/Suite 419., Etobicoke ON, M9C 4Z5. 416-626-6027. 416-626-6139. Branch/Distributors: St. Lawrence Chemical, Montreal, Toronto

Vapor Blast Mfg. Co. 3025 West Atkinson Avenue, Milwaukee WI, 53209.

414-871-6500. 414-871-7683. Branch/Distributors: Truechem, Montreal, PQ;

Van Waters & Rogers 64 Arrow Road., Weston, ON, M9M 2L9. 416-741-9190.

416-741-4510. Branch/Distributors: Weston, Vancouver, Edmonton, Windsor, Dartmouth, Calgary, Montreal, Winnipeg, Regina;

Vibra Finish 5329 Maingate Drive, Mississauga, ON, L4W 1G6. 416-625-9955.

Viking Pump 661 Grove Avenue., Windsor ON, N9A 6M3. 519-256-5438. 519-256-5070. Branch/Distributors: Atlas Engineering, Toronto, ON; St. Laurent, PQ; Moncton, NB: Viking Pump, Burnaby, BC; Edmonton, AB; Calgary, AB; Winnipeg, MB;

Vorti-Siv/MM Industries Inc. 36135 Salem Grange Road., Salem OH USA, 44460. 216-332-4958. 216-332-1543. Branch/Distributors: L.V. Lomas Chemical, Mississauga, ON; Dorval, PQ; Surrey, BC.

W

Wagner Systems Inc. 700 High Grove Blvd., Glendale Heights, IL, 601399998. 708-924-2400. 708-924-2419.

Wagner Systems Inc. 700 High Grove Blvd., Glendale Heights, IL, 601399998. 708-924-2400. 708-924-2419.

Wainbee Limited 5789 Coopers Avenue, Mississauga, ON, L4Z 3S6. 905-568-1700. 905-213-7207. Branch/Distributors: Quebec, Richmond, Edmonton, Winnipeg, Kitchener, London, Montreal, Ottawa, Halifax, Calgary, Windsor, North Bay, Waldie Chemicals Limited 6600 Trans Canada Hwy., Pointe Claire PQ, H9R 4S2. 514-697-8332.

Walker Peenimpac 2010 Cypress Street., Valdosta GA, 31601. 912-242-6824. 912-245-8472. Branch/Distributors: ProQuip Consultants, North York, ON

Wallace & Tiernan Canada Inc. 925 Warden Avenue., Scarborough ON, M1L 4C5. 416-751-7561. Branch/Distributors: Dartmouth, Montreal, St. John's, NF

Warrender 3685 Commercial Ave., Northbrook, IL, 60062. 708-272-0227. 708-272-9337.

Warren Rupp Inc. A Unit of IDEX Corp. P.O. Box 1568, Mansfield OH USA, 44901. 419-524-8388. Branch/Distributors: John Brooks Co., Pointe Claire, PQ; Calgary, AB; Mississauga, ON; Winnipeg, MB; Coquitlam, BC; Oliver Ind. Supply, Calgary, AB; Plad Equipment, St. Laurent, PQ; Windsor Pump, Windsor, ON; Fleck Brothers, Burnaby, BC;

Watts Regulator 441 Hanlan Road., Woodbridge ON, L4L 3T1. 416-851-8591. 416-851-8788. Branch/Distributors: Calgary, Quebec, Winnipeg, Halifax, St. Johns, Vancouver, Moncton, Regina

Weathering Research 23435 Southwest 127th Ave, Princeton FL, 33032. 305-258-3287.

Western Reserve 5311 W. River Rd. N., Lorain, OH, 44055. 216-277-1226.

Westglen Industries Inc. 331 Martin Street., Milton ON, L9T 2R7. 905-876-2705. 905-875-3531.

Westinghouse P.O. Box 510/Station A., Hamilton ON, L8N 3K2. 416-528-8811.

Whittaker Clark 135 Bethridge Road, Rexdale, ON, M4W 1N4. 416-744-6580.

Wilden Pump 22069 Van Buren Street., Colton CA, 92324. 714-783-0621.

Wilkerson 1201 West Mansfield Ave., Englewood CO, 80110. 303-761-7601. Branch/Distributors: CFM Air Equipment, Calgary, AB Royal Fluid Power Ltd., Burlington, ON Skeans Eng. & Mch. Ltd., Vancouver, BC

Wilkie Bros. P.O. Box 219, Marysville, MI, 48040. 313-364-4820. Branch/Distributors: Mr. Jim Ahles, Cdn. Sales Rep., Cdn. Sales Office;

Williams & Wilson 1300 Rue St. Patrick., Montreal PQ, H3K 1A4. 514-939-1300. 514-939-3897. Branch/Distributors:

Wabush, Quebec, Sept Iles, Arvida, Toronto Windsor, Ottawa, Edmonton, Trois Rivières, Burnaby;

Windsor Pump Co. Ltd. 3057 Marentette, Windsor, ON, N8X 4G1. 519-969-2190. 519-969-2047. Branch/Distributors: Mississauga, ON; 416-569-9565;

Wirt & Knox 150 Gordon Drive., Lionville PA, 19353. 215-363-1400. Branch/Distributors: Fleck Bros. Ltd., Vancouver, BC General Fire Service, Montreal, PQ Industries CFH Ltee., Pointe Claire, PQ Safety Supply Co., Toronto, ON Levitt-Safety Ltd., Toronto, ON National Fire Equipment, Scarborough, ON

Witcon Protective P.O. Box 8147, Green Bay WI, 54308 417. 414-437-6561. 414-437-8083. Branch/Distributors: Corrosion Service Co., Downsview, Samia, Montreal North Vancouver, Dartmouth, Calgary, Edmonton

Witco Canada 2 Lansing Square/Stie 1200, Willowdale ON, M2J 4Z4. 416-497-9991. 416-497-7110. Branch/Distributors: Montreal, PQ; Calgary, AB; Vancouver, BC Wizard Group Old Buffalo Road., Dale IN, 47523. 812-937-4476.

W.S. Wood 1730 Bishop St. - 3A, Cambridge, ON, N1T 1N4. 519-622-1133.

Wood-Kote Products Inc. 8000 NE 14th Place., Portland Oregon, 97211. 503-285-8371. 503-285-8374. Branch/Distributors: Paint Sundry Products, Mississauga, ON 416-890-1225;

Wormald Fire 135 Matheson Blvd. E., Mississauga ON, L4Z 1R2. 416-890-1440.

X Y Z

X-Rite Inc. 3100 44th St., Grandville, MI USA, 49418. 616-534-7663.

616-534-0723. Branch/Distributors: Manuluf, Montreal, PQ; 514-591-9913;

York Belting 329 Deerhide Crescent., Weston ON, M9M 2Z2. 416-741-9675. 416-741-2873.

York Fluid 2 Westwyn Court., Brampton ON, L6T 4T5. 905-454-4013. 905-454-8423.

Zeelan Industries Inc. 3M Center Bldg. 220-8E-04, St. Paul MN USA, 55144-1000. 612-737-1751. Branch/Distributors: L.V. Lomas Ltd., Brampton, ON; Dorval, PQ;

Zeneca Resins 730 Main Street., Wilmington MA, 01887. 508-658-6600. Branch/Distributors: Brantford, ON;

Zochem 1 Tilbury Ct/PO Box 1120., Brampton ON, L6V 2L8. 416-453-4100. Branch/Distributors: Chemcore, Kirkland, PQ; MacKenzie and Feimann, Vancouver, Calgary, Winnipeg

Zorelco 8520 Garfield Blvd., Cleveland OH USA, 44125. 216-441-6100. 216-441-6103.

Turn P.O. Box 13801/1335 W 12, Erie PA, 16514. 814-453-3651. Branch/Distributors: Wainbee Ltd., Rexdale, ON; Dorval, PQ; Vancouver, BC

APPENDIX F

IESP INFORMATION ON ADHESIVES AND PAINT & COATINGS INDUSTRIES

IESP INFORMATION ON ADHESIVES AND PAINT & VARNISH INDUSTRIES

To date the Ministry of Environment and Energy has completed 8 energy audits in the Adhesives and Paint & Varnish sectors (3 in Adhesives and 5 in Paint & Varnish, respectively).

Annual consumption cost of energy: the total annual energy consumption cost for the 8 plants is \$2.9 million (see Table 1), averaging \$362,000. The largest plant consumes over \$800,000 of energy per year.

Potential annual cost savings: for the above mentioned annual consumption, the energy analyses have identified \$300,000 in potential savings per year (Table 1) . This translates into an average potential savings of 10.4% of the annual consumption cost. In one case the potential savings are as high as 32%.

Potential annual energy savings: the 8 Adhesives and Paint & Varnish plants consume about 377 petajoules of electricity and natural gas. The savings are equivalent to 50 petajoules or 13% of the annual consumption.

Energy Efficiency Opportunities (EEO): the energy audits identified 30 EEO in these 8 plants. Table 2 shows the generic description of these EEO along with the capital expenditure needed to implement them, the savings that can occur as a result of their implementation and the simple payback period for each item. In total, in order to realize the \$300,000 savings a capital investment of \$610,000 is necessary, which means a

Feb 10, 1994
TABLE 1: AUDITS IN ADHESIVES AND PAINT & VARNISH INDUSTRIES

SIC	Annual Energy Consumption	Potential Annual Savings	% of Savings
3751	\$299,535	\$97,900	32.7
	\$275,528	\$32,445	11.6
	\$253,118	\$32,087	12.7
	\$184,860	\$12,237	6.6
	\$124,593	\$14,550	11.7
Tot:	\$1,137,634	\$189,219	
3792	\$823,755	\$36,283	4.4
	\$537,234	\$42,500	7.9
	\$395,781	\$32,675	8.3
Tot:	\$1,756,770	\$111,458	
Total:			
Average:	\$2,894,404	\$300,677	
Maximum:	\$361,801	\$37,365	
Minimum:			
			32.7
			4.4

TABLE 2: EEO IN ADHESIVES AND PAINT & VARNISH INDUSTRIES

EEO DESCRIPTION	CAPITAL EXPENDITURE	POTENTIAL ANNUAL SAVINGS	PAYBACK PERIOD
Power factor improvement	\$1,675	\$566	2.96
	\$3,000	\$1,580	1.90
Total:	\$4,675	\$2,146	
Install high intensity discharge (HID) lighting	\$1,558	\$443	3.50
Total:	\$1,558	\$443	
Install low wattage fluorescent tubes	\$658	\$1,364	0.48
	\$1,345	\$2,335	0.58
Total:	\$2,003	\$3,699	
Reduce compressed air system leaks	\$2,734	\$2,300	1.19
	90	\$1,525	0.00
Total:	\$2,734	\$3,825	
Reduction in other electrical utility charges	\$200,000	\$83,100	2.41
Total:	\$200,000	\$83,100	
Building infiltration reduction (weather stripping, doors, windows)	\$800	\$800	1.00
	\$385	\$565	0.68
	\$540	\$13,800	0.04
Total:	\$1,725	\$15,165	
Heat exchange techniques to precondition incoming air with exhaust air	\$130,000	\$22,306	5.83
Total:	\$130,000	\$22,306	
Install timed equipment to control HVAC	\$3,800	\$2,530	1.50
	\$5,346	\$4,465	1.20
Total:	\$9,146	\$6,995	
General HVAC improvements	\$45,000	\$27,500	1.64
Total:	\$45,000	\$27,500	
Use destratification fans	\$11,000	\$9,215	1.19
	\$3,000	\$1,500	2.00
Total:	\$14,000	\$10,715	
Set correct fuel/air ratio	\$400	\$1,000	0.40
Total:	\$400	\$1,000	
Miscellaneous boiler efficiency improvements	\$2,800	\$950	2.95
Total:	\$2,800	\$950	

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TABLE 2: EEO IN ADHESIVES AND PAINT & VARNISH INDUSTRIES

EEO DESCRIPTION	CAPITAL EXPENDITURE	POTENTIAL ANNUAL SAVINGS	PAYBACK PERIOD
Heat recovery from flue gases for process heat	\$15,000	\$5,000	3.00
Total:	\$15,000	\$5,000	
Combustion heat confinement	\$10,470	\$6,585	1.59
Total:	\$10,470	\$6,585	
Steam trap upgrading/repair	\$1,200	\$14,000	0.09
Total:	\$1,200	\$14,000	
Equipment replacement	\$25,000	\$31,600	0.79
Total:	\$25,000	\$31,600	
Heat recovery for combustion air preheat (recuperators)	\$36,200	\$10,000	3.62
Total:	\$36,200	\$10,000	
Heat recovery from exhaust or effluent streams for process use	\$23,464	\$21,305	1.10
Total:	\$23,464	\$21,305	
Recovery of heat from equipment for process use (air compressor)	\$50,000	\$10,000	5.00
	\$13,947	\$8,167	1.70
	\$7,000	\$3,103	2.26
Total:	\$70,947	\$21,270	
Process ventilation reductions	\$0	\$1,773	0.00
Total:	\$0	\$1,773	
Miscellaneous energy	\$14,200	\$11,300	1.26
Total:	\$14,200	\$11,300	
total:	\$610,522	\$300,677	
Count:	30		

simple payback period of 2 years.

Table 3 is a listing of those EEO that are process-related (also included in Table 2). Data in this Table suggest that the main areas of process-related potential energy savings are in Heat Recovery from various stages of the Process. Appendix I is an extract from the reports prepared by the consulting firms that conducted the audits, showing specific process-related energy efficiency opportunities for those plants where such EEO were identified. The process-related EEO represent 23% of the total potential savings.

EEO by Fuel Type: in Table 4 the EEO identified in the course of the 8 audits have been broken down by fuel type. From these data, it is clear that the majority of the opportunities lie in conservation of natural gas. Of the total potential savings, about \$126,000 or 42% is in electricity and about \$160,000 or 53% is in natural gas.

With respect to capital spending needed to implement these EEO the percentages are slightly more polarized. To realize the \$300,000 savings a capital spending of about \$236,000 in electricity applications and \$356,000 in natural gas applications are needed. These figures represent 38% and 58% of the total capital expenditure, respectively. Thus the simple payback period for electricity is better (1.8 years) than that of natural gas (2.2 years).

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TABLE 3: PROCESS-RELATED EEO IN ADHESIVES AND PAINT & VARNISH INDUSTRIES

EEO DESCRIPTION	CAPITAL EXPENDITURE	POTENTIAL ANNUAL SAVINGS
Equipment replacement		
Total:	\$25,000	\$31,600
Heat recovery for combustion air preheat (recuperators)	\$25,000	\$31,600
Total:	\$36,200	\$10,000
Heat recovery from exhaust or effluent streams for process use	\$36,200	\$10,000
Total:	\$23,464	\$21,305
Process ventilation reductions	\$23,464	\$21,305
Total:	\$0	\$1,773
Recovery of heat from equipment for process use (air compressor)	\$0	\$1,773
Total:	\$7,000	\$3,103
	\$13,947	\$8,167
	\$50,000	\$10,000
Total:	\$70,947	\$21,270
Total:	\$155,611	\$85,948
Count:	7	

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TABLE 4: EEO IN ADHESIVES AND PAINT & VARNISH INDUSTRIES BY FUEL TYPE

FUEL TYPE	EEO DESCRIPTION	CAPITAL EXPENDITURE	POTENTIAL ANNUAL SAVINGS
1	Equipment replacement	\$25,000	\$31,600
	Install high intensity discharge (HID) lighting	\$1,558	\$443
	Install low wattage fluorescent tubes	\$1,345	\$2,335
		\$658	\$1,564
	Power factor improvement	\$1,675	\$566
		\$3,000	\$1,580
	Process ventilation reductions	\$0	\$1,773
	Reduce compressed air system leaks	\$2,734	\$2,300
		\$0	\$1,525
	Reduction in other electrical utility charges	\$200,000	\$83,100
*****	*****	*****	*****
Total:		\$235,970	\$126,586
Count:	10		

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TABLE 4: EEO IN ADHESIVES AND PAINT & VARNISH INDUSTRIES BY FUEL TYPE

FUEL TYPE	EEO DESCRIPTION	CAPITAL EXPENDITURE	POTENTIAL ANNUAL SAVINGS
2	Building infiltration reduction (weather-stripping, doors, windows)	\$365 \$540	\$565 \$13,800
	Combustion heat confinement	\$10,470	\$6,585
	General HVAC Improvements	\$45,000	\$27,500
	Heat exchange techniques to precondition Incoming air with exhaust air	\$130,000	\$22,306
	Heat recovery for combustion air preheat (recuperators)	\$36,200	\$10,000
	Heat recovery from exhaust or effluent streams for process use	\$23,464	\$21,305
	Heat recovery from flue gases for process heat	\$15,000	\$5,000
	Install timed equipment to control HVAC	\$5,346 \$3,800	\$4,465 \$2,530
	Miscellaneous boiler efficiency improvements	\$2,800	\$950
	Recovery of heat from equipment for process use (air compressor)	\$13,947 \$7,000 \$50,000	\$8,167 \$3,103 \$10,000
	Set correct fuel/air ratio	\$400	\$1,000
	Steam trap upgrading/repair	\$1,200	\$14,000
	Use destratification fans	\$11,000	\$9,215
Total:		\$356,552	\$160,491
Count:		17	

1: Electricity
2: Natural Gas
4: Light Fuel Oil

FEB 14, 1994

TABLE 4: EEO IN ADHESIVES AND PAINT & VARNISH INDUSTRIES BY FUEL TYPE

FUEL TYPE	EEO DESCRIPTION	CAPITAL EXPENDITURE	POTENTIAL ANNUAL SAVINGS
4	Building infiltration reduction (weather stripping, doors, windows)	\$800	\$800
	Miscellaneous energy	\$14,200	\$11,300
	Use destratification fans	\$3,000	\$1,500
Total:		\$18,000	\$13,600
Count:	3		

1: Electricity
2: Natural Gas
3: Light Fuel Oil

Implementation of EEO: one to two years after the completion of the audits follow up visits are conducted to gather information on actions taken on the audits recommendations. For the 8 plants and 30 EEO, implementation action for 6 plants and 24 EEO is available. Of these 24 EEO, 14 EEO (or 58%) have been implemented of are planned to be implemented in the near future (Figure 1). In terms of annual savings they represent 66% of the potential savings (Figure 2) and in terms of capital expenditure they reflect 33% of the investment needed for the 24 EEO.

Prepared by Soussan Tabari

February 14, 1994

Feb 14, 1994
TABLE 5: IMPLEMENTED/PLANNED TO BE IMPLEMENTED EEO IN ADHESIVES AND PAINT
& VARNISH SECTORS

EEO DESCRIPTION	CAPITAL EXPENDITURE	POTENTIAL ANNUAL SAVINGS	PAYBACK PERIOD
Install high intensity discharge (HID) lighting	\$1,558	\$443	3.50
Total:	\$1,558	\$443	
Install low wattage fluorescent tubes	\$1,345	\$2,335	0.58
	\$658	\$1,364	0.48
Total:	\$2,003	\$3,699	
Reduce compressed air system leaks	\$0	\$1,325	0.00
Total:	\$0	\$1,325	
Building infiltration reduction (weather stripping, doors, windows)	\$365	\$565	0.68
	\$800	\$800	1.00
Total:	\$1,165	\$1,365	
Use destratification fans	\$3,000	\$1,500	2.00
	\$9,215	\$9,215	1.19
Total:	\$14,000	\$10,715	
Miscellaneous boiler efficiency improvements	\$2,800	\$950	2.95
Total:	\$2,800	\$950	
Steam trap upgrading/repair	\$1,200	\$16,000	0.09
Total:	\$1,200	\$16,000	
Equipment replacement	\$25,000	\$31,600	0.79
Total:	\$25,000	\$31,600	
Heat recovery from exhaust or effluent streams for process use	\$23,464	\$21,305	1.10
Total:	\$23,464	\$21,305	
Recovery of heat from equipment for process use (air compressor)	\$13,947	\$8,167	1.70
Total:	\$13,947	\$8,167	
Miscellaneous energy	\$14,200	\$11,300	1.26
Total:	\$14,200	\$11,300	
Total:	\$99,357	\$105,069	

**ACTIONS TAKEN ON AUDIT RECOMMENDATIONS
IN ADHESIVES AND PAINT & VARNISH SECTORS**

Based on 24 EEO

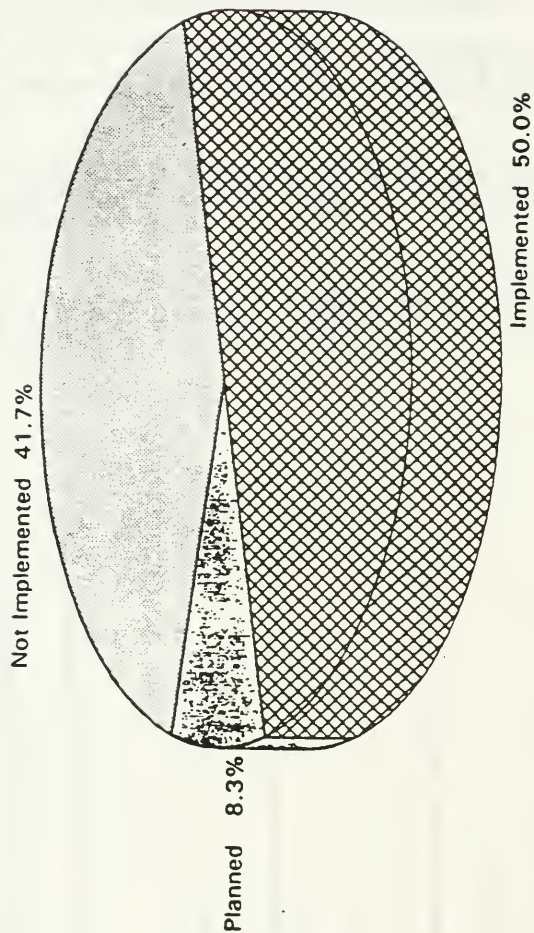


Figure 1

**ANNUAL SAVINGS RESULTED FROM IMPLEMENTATION OF
14 EEO IN ADHESIVES AND PAINT & VARNISH SECTORS**

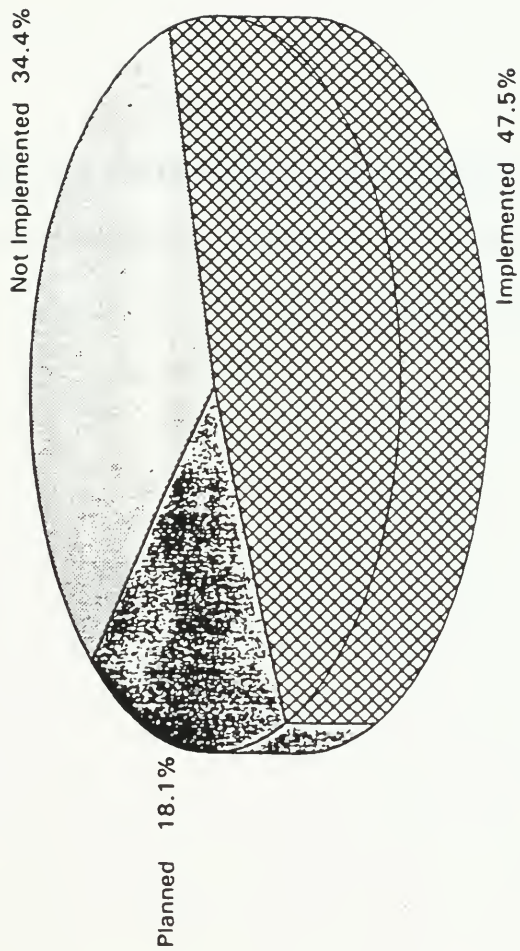


Figure 2: Total savings = \$105,000

- APPENDIX G

GUIDELINES FOR USING THE WASTE MINIMIZATION ASSESSMENT WORKSHEETS

SOURCES: GUIDES TO POLLUTION PREVENTION

THE PAINT MANUFACTURING/INDUSTRY

EPA/625/7-90/005

SECTION 4

GUIDELINES FOR USING THE WASTE MINIMIZATION ASSESSMENT WORKSHEETS

Waste minimization assessments were conducted at several paint manufacturing plants in the Los Angeles area. The assessments were used to develop the waste minimization questionnaire and worksheets that are provided in the following section.

A comprehensive waste minimization assessment includes a planning and organizational step, an assessment step that includes gathering background data and information, a feasibility study on specific waste minimization options, and an implementation phase.

Conducting Your Own Assessment

The worksheets provided in this section are intended to assist paint manufacturers in systematically evaluating waste generating processes and in identifying waste minimization opportunities. These worksheets include only the assessment phase of the procedure described in the Waste Minimization Opportunity Assessment Manual. For a full description of waste minimization assessment procedures, refer to the EPA Manual.

Table 5 lists the worksheets that are provided in this section.

Table 5. List of Waste Minimization Assessment Worksheets

Number	Title	Description
1.	Waste Sources	Typical wastes generated at paint manufacturing plants.
2A.	Waste Minimization: Material Handling	Questionnaire on general handling techniques for raw material handling.
2B.	Waste Minimization: Material Handling	Questionnaire on procedures used for bulk liquid handling.
2C.	Waste Minimization: Material Handling	Questionnaire on procedures used for handling drums, containers and packages.
3.	Option Generation: Material Handling	Waste minimization options for material handling operations.
4.	Waste Minimization: Material Substitution/ Primary Dispersion Techniques	Questionnaire on material substitution and primary dispersion operations.
5.	Option Generation: Material Substitution/ Primary Dispersion Techniques	Waste minimization options for material substitution and modification of the primary dispersion operations.
6.	Waste Minimization: Process Modification (Let-Down)	Questionnaire on let-down procedures.
7.	Option Generation: Let-Down Techniques	Waste minimization opportunities for let-down techniques.
8.	Waste Minimization: Process Modification (Filtering and Filling)	Questionnaire on filtering, filling, and on-site tank cleaning procedures.
9.	Option Generation: Filtering and Filling	Filtering and filling waste minimization options.
10.	Waste Minimization: Good Operating Practices	Questionnaire on use of good operating practices.
11.	Option Generation: Good Operating Practices	Waste minimization options for good operating practices.
12.	Waste Minimization: Reuse and Recovery	Questionnaire on opportunities for reuse and recovery of wastes.

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____		Checked By _____
Date _____	Proj. No. _____	Sheet ____ of ____ Page ____ of ____

WORKSHEET

1

WASTE SOURCES

Waste Source: Material Handling	Significance at Plant		
	Low	Medium	High
Off-spec materials			
Obsolete raw materials			
Obsolete products			
Spills & leaks (liquids)			
Spills (powders)			
Empty container cleaning			
Container disposal (metal)			
Container disposal (paper)			
Pipeline/tank drainage			
Laboratory wastes			
Evaporative losses			
Other			
Waste Source: Process Operations			
Mill cleaning			
Portable tank cleaning			
Container cleaning			
Stationary tank cleaning			
Mixer cleaning			
Filter equipment cleaning			
Spent filter elements			
Filling equipment cleaning			
Baghouse fines			
Other			

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____		Checked By _____
Date _____	Proj. No. _____	Sheet ____ of ____ Page ____ of ____

WORKSHEET
2A

WASTE MINIMIZATION:
Material Handling

A. GENERAL HANDLING TECHNIQUES

Are all raw materials tested for quality before being accepted from suppliers? ☐ yes ☐ no

Describe safeguards to prevent the use of materials that may generate off-spec product: _____

Is obsolete raw material returned to the supplier? ☐ yes ☐ no

Is inventory used in first-in first-out order? ☐ yes ☐ no

Is the inventory system computerized? ☐ yes ☐ no

Does the current inventory control system adequately prevent waste generation?

What information does the system track? ☐ yes ☐ no

Is there a formal personnel training program on raw material handling, spill prevention, proper storage techniques, and waste handling procedures? ☐ yes ☐ no

Does the program include information on the safe handling of the types of drums, containers and packages received? ☐ yes ☐ no

How often is training given and by whom? _____

Firm _____	Waste Minimization Assessment	Prepared By _____
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Date _____	Proj. No. _____	Sheet ____ of ____ Page ____ of ____

WORKSHEET

2B

WASTE MINIMIZATION:
Material Handling

B. BULK LIQUIDS HANDLING

What safeguards are in place to prevent spills and avoid ground contamination during the filling of storage tanks?

High level shutdown/alarms ☐ Secondary containment ☐
Flow totalizers with cutoff ☐ Other ☐

Describe the system: _____

Are air emissions from solvent storage tanks controlled by means of:

Conservation vents	<input type="checkbox"/> yes	<input type="checkbox"/> no
Nitrogen blanketing	<input type="checkbox"/> yes	<input type="checkbox"/> no
Absorber/Condenser	<input type="checkbox"/> yes	<input type="checkbox"/> no
Other vapor loss control system	<input type="checkbox"/> yes	<input type="checkbox"/> no

Describe the system: _____

Are all storage tanks routinely monitored for leaks?

☐ yes ☐ no

Describe procedure and monitoring frequency for above-ground/vaulted tanks: _____

Underground tanks: _____

How are the liquids in these tanks dispensed to the users? (i.e., in small containers or hard piped.) _____

What measures are employed to prevent the spillage of liquids being dispensed? _____

When a spill of liquid occurs in the facility, what cleanup methods are employed (e.g., wet or dry)? Also discuss the way in which the resulting wastes are handled: _____

Would different cleaning methods allow for direct reuse or recycling of the waste? (explain): _____

Firm _____	Waste Minimization Assessment	Prepared By _____
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WORKSHEET

2C

**WASTE MINIMIZATION:
Material Handling**

C. DRUMS, CONTAINERS, AND PACKAGES

- Are drums, packages, and containers inspected for damage before being accepted? ☐ yes ☐ no
- Are employees trained in ways to safely handle the types of drums & packages received? ☐ yes ☐ no
- Are they properly trained in handling of spilled raw materials? ☐ yes ☐ no
- Are stored items protected from damage, contamination, or exposure to rain, snow, sun & heat? ☐ yes ☐ no

Describe handling procedures for damaged items: _____

- Does the layout of the facility result in heavy traffic through the raw material storage area? ☐ yes ☐ no
- (Heavy traffic increases the potential for contaminating raw materials with dirt or dust and for causing spilled materials to become dispersed throughout the facility.) ☐ yes ☐ no
- Can traffic through the storage area be reduced? ☐ yes ☐ no

To reduce the generation of empty bags & packages, dust from dry material handling and liquid wastes due to cleaning of empty raw material drums and/or customer returns, has the facility attempted to:

- Use pigments in slurry/paste form? ☐ yes ☐ no
- Purchase hazardous materials in preweighed containers to avoid the need for weighing? ☐ yes ☐ no
- Purchase preweighed hazardous materials in water or solvent soluble bags? ☐ yes ☐ no
- Use reusable/recyclable drums with liners instead of paper bags? ☐ yes ☐ no
- Use larger containers or bulk delivery systems that can be returned to supplier for cleaning? ☐ yes ☐ no
- Dedicate baghouse systems in the pigment loading area so as to segregate hazardous from non-hazardous dusts? ☐ yes ☐ no
- Reformulate the cleaning waste into a product? ☐ yes ☐ no

Discuss the results of these attempts: _____

- Are all empty bags, packages, and containers that contained hazardous materials segregated from those that contained non-hazardous wastes? ☐ yes ☐ no

Describe method currently used to dispose of this waste: _____

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____	Proc. Unit/Oper. _____	Checked By _____
Date _____	Proj. No. _____	Sheet ____ of ____ Page ____ of ____

WORKSHEET

3

OPTION GENERATION:
Material Handling

Meeting Format (e.g., brainstorming, nominal group technique) _____

Meeting Coordinator _____

Meeting Participants _____

Suggested Waste Minimization Options	Currently Done Y/N?	Rationale/Remarks on Option
A. General Handling Techniques		
Quality Control Check		
Return Obsolete Material To Supplier		
Minimize Inventory		
Computerize Inventory		
Formal Training		
B. Bulk Liquids Handling		
High Level Shutdown/Alarm		
Flow Totalizers with Cutoff		
Secondary Containment		
Air Emission Control		
Leak Monitoring		
Spilled Material Reuse		
Cleanup Methods to Promote Recycling		
C. Drums, Containers, and Packages		
Raw Material Inspection		
Proper Storage/Handling		
Slurry/Paste Pigments		
Preweghed Containers		
Soluble Bags		
Reusable Drums		
Bulk Delivery		
Dedicated Baghouses		
Waste Segregation		
Reformulate Cleaning Waste		

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____		Checked By _____
Date _____		Sheet ____ of ____ Page ____ of ____
Proj No _____		

WORKSHEET

4

**WASTE MINIMIZATION:
Material Substitution
Primary Dispersion Techniques**

A. MATERIAL SUBSTITUTION

Do any of the paints or coatings produced contain hazardous materials (i.e., chlorinated solvents, lead or chrome pigments, mercury, etc.)?

☐ yes ☐ no

If yes, has material substitution been tried?

☐ yes ☐ no

Discuss the results _____

B. PRIMARY DISPERSION (skip this section if mills not used)

Are separate containers used for feeding and receiving materials passed through the mill?

☐ yes ☐ no

Are multiple passes of the material through the mill often required?

☐ yes ☐ no

Can the number of containers used (requiring cleaning) be reduced by continuously recirculating the material through the mill instead of using multiple passes?

☐ yes ☐ no

Would the purchase of a more efficient mill eliminate the need for multiple passes?

☐ yes ☐ no

Is dispersed material used immediately for let-down?

☐ yes ☐ no

If sent to storage, does the material often require redispersion?

☐ yes ☐ no

Would reducing the amount of material sent to intermediate storage reduce the use of the mill and the subsequent need for cleaning?

☐ yes ☐ no

Discuss: _____

Is solvent used for cleaning the mills?

☐ yes ☐ no

Can the cleaning waste be used as part of the formulation during let-down?

☐ yes ☐ no

As part of another formulation or for other cleaning activities?

☐ yes ☐ no

Can the type of cleaning agent be standardized so as to promote reuse or recycling?

☐ yes ☐ no

Discuss: _____

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____	Proc. Unit/Oper. _____	Checked By _____
Date _____	Proj. No. _____	Sheet ____ of ____ Page ____ of ____

WORKSHEET

5

**OPTION GENERATION:
Material Substitution
Primary Dispersion Techniques**

Meeting format (e.g., brainstorming, nominal group technique) _____

Meeting Coordinator _____

Meeting Participants _____

Suggested Waste Minimization Options	Currently Done Y/N?	Rationale/Remarks on Option
A. Substitution/Reformulation Techniques		
Pigment Substitution		
Solvent Substitution		
Product Reformulation		
Other Raw Material Substitution		
B. Primary Dispersion Techniques		
Recirculation Through Mill		
Install Efficient Mills		
Improve Production Planning		
Dedicate Mills		
Clean with Part of Batch		
Reuse Rinse Solvent		
Standardize Cleaning Solvent		
Mechanical Cleaning		
Waste Segregation		

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____		Checked By _____
Date _____	Proj. No. _____	Sheet ____ of ____ Page ____ of ____

WORKSHEET

6

WASTE MINIMIZATION:
Process Modification

LET-DOWN TANKS

Is the piping to and from the let-down tanks routinely flushed with water or solvent?

☐ yes

☐ no

Is the piping "pigged" before flushing?

☐ yes

☐ no

Describe how waste from flushing is handled: _____

Describe the cleaning sequence (i.e., manually scraped, washed with a high-pressure spray system using caustic then solvent rinsed) used for cleaning portable let-down tanks: _____

Describe the cleaning sequence used for cleaning fixed let-down tanks: _____

Describe the cleaning sequence used for cleaning the mixing units: _____

How are cleaning wastes handled and disposed of? _____

Much more drastic cleaning measures are usually required when the paint is allowed to dry inside the tank. Are all of the tanks cleaned promptly after use?

☐ yes

☐ no

Are any precautions taken during this time to prevent the paint from drying?

☐ yes

☐ no

Describe: _____

Are there established procedures for communications between cleaning & production crew?

☐ yes

☐ no

For situations where the paint does dry in the tank, is your spray cleaning system effective?

☐ yes

☐ no

Has the use of new nozzle heads or higher pump pressures been attempted?

☐ yes

☐ no

If a high-pressure spray system is not used for cleaning tanks, are there plans to install one?

☐ yes

☐ no

If caustic is used, have alternative commercial cleaning solutions been tried?

☐ yes

☐ no

Results: _____

Can batches be sequenced from light-to-dark to reduce cleaning needs?

☐ yes

☐ no

Has the facility investigated the effect of reduced cleaning on product quality?

☐ yes

☐ no

Was the testing performed on a lab scale or in production?

☐ yes

☐ no

Results: _____

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____		Checked By _____
Date _____		Proj No _____
		Sheet ____ of ____ Page ____ of ____

WORKSHEET

8

WASTE MINIMIZATION:
Process Modification

FILTERING & FILLING

Are any of the filter units dedicated to a particular product line? ☐ yes ☐ no

Would increased dedication reduce the need for filter replacement or cleaning? ☐ yes ☐ no

Has the facility attempted to replace disposable cartridge filters with reusable filters such as bags or metal mesh? ☐ yes ☐ no

What type of reusable filter was tried and what were the results: _____

How are the wastes from spent filter cartridges or reusable filter cleaning handled? _____

Are any of the filling units dedicated to a particular product line? ☐ yes ☐ no

Would increased dedication reduce the need for cleaning? ☐ yes ☐ no

Describe the filling unit cleaning procedures and how cleaning wastes are handled _____

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____		Checked By _____
Date _____	Proj. No. _____	Sheet ____ of ____ Page ____ of ____

WORKSHEET

10

**WASTE MINIMIZATION:
Good Operating Practices**

A. PRODUCTION SCHEDULING TECHNIQUES

Is the production schedule varied to decrease waste generation? (For example, do you attempt to increase size of production runs and minimize cleaning by accumulating orders or production for inventory?) ☐ yes ☐ no

Describe _____

Does the production include light-to-dark manufacturing sequence? ☐ yes ☐ no

If yes, indicate results: _____

Are there any other attempts at eliminating cleanup steps between subsequent batches? ☐ yes ☐ no

If yes, results: _____

B. AVOIDING OFF-SPEC PRODUCTS

Is the batch formulation attempted in the lab before large scale production? ☐ yes ☐ no

C. GOOD OPERATING PRACTICES

Are plant material balances routinely performed? ☐ yes ☐ no

Are they performed for each material of concern (e.g. solvent) separately? ☐ yes ☐ no

Are records kept of individual wastes with their sources of origin and eventual disposal? ☐ yes ☐ no

(This can aid in pinpointing large waste streams and focus reuse efforts.)

Are the operators provided with detailed operating manuals or instruction sets? ☐ yes ☐ no

Are all operator job functions well defined? ☐ yes ☐ no

Are regularly scheduled training programs offered to operators? ☐ yes ☐ no

Are there employee incentive programs related to waste minimization? ☐ yes ☐ no

Does the facility have an established waste minimization program in place? ☐ yes ☐ no

If yes, is a specific person assigned to oversee the success of the program? ☐ yes ☐ no

Discuss goals of the program and results: _____

Has a waste minimization assessment been performed at the facility in the past? ☐ yes ☐ no

If yes, discuss: _____

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____	Proc. Unit/Oper. _____	Checked By _____
Date _____	Proj. No. _____	Sheet ____ of ____ Page ____ of ____

WORKSHEET

11

**OPTION GENERATION:
Good Operating Practices**

Meeting format (e.g., brainstorming, nominal group technique) _____

Meeting Coordinator _____

Meeting Participants _____

Suggested Waste Minimization Options	Currently Done Y/N?	Rationale/Remarks on Option
A. Production Scheduling Techniques		
Increase Size of Production Run		
Light-to-Dark Sequence		
Avoid Unnecessary Cleaning		
B. Avoiding Off-Spec Products		
Test Batch Formulation in Lab		
C. Good Operating Practices		
Perform Material Balances		
Keep Records of Waste Sources & Disposition		
Waste/Materials Documentation		
Provide Operating Manuals/Instructions		
Employee Training		
Increased Supervision		
Provide Employee Incentives		
Encourage Dry Cleanup		
Increase Plant Sanitation		
Establish Waste Minimization Policy		
Set Goals for Source Reduction		
Set Goals for Recycling		
Conduct Annual Assessments		

Firm _____	Waste Minimization Assessment	Prepared By _____
Site _____		Checked By _____
Date _____	Proj No _____	Sheet ____ of ____ Page ____ of ____

WORKSHEET

12

**WASTE MINIMIZATION:
Reuse and Recovery**

A. SEGREGATION

Segregation of wastes reduces the amount of unknown material in waste and improves prospects for reuse & recovery.

Are different solvent wastes due to equipment clean-up segregated? ☐ yes ☐ no
 Are aqueous wastes from equipment clean-up segregated from solvent wastes? ☐ yes ☐ no
 Are spent alkaline solutions segregated from the rinse water streams? ☐ yes ☐ no
 If no, explain: _____

B. ON-SITE RECOVERY

On-site recovery of solvents by distillation is economically feasible for as little as 8 gallons of solvent waste per day.

Has on-site distillation of the spent solvent ever been attempted? ☐ yes ☐ no
 If yes, is distillation still being performed? ☐ yes ☐ no
 If no, explain: _____

C. CONSOLIDATION/REUSE

Are many different solvents used for cleaning? ☐ yes ☐ no
 If too many small-volume solvent waste streams are generated to justify on-site distillation, can the solvent used for equipment cleaning be standardized? ☐ yes ☐ no
 Is spent cleaning solvent reused? ☐ yes ☐ no
 Are there any attempts at making the rinse solvent part of a batch formulation (rework)? ☐ yes ☐ no
 Are any attempts made to blend various waste streams to produce marketable products? ☐ yes ☐ no
 Are spills collected and reworked? ☐ yes ☐ no
 Describe which measures were successful and for which types of paint: _____

Is your solvent waste segregated from other wastes? ☐ yes ☐ no
 Has off-site reuse of wastes through Waste Exchange services been considered? ☐ yes ☐ no
 Or reuse through commercial brokerage firms?
 If yes, results: _____

APPENDIX H

ADVANCED WASTE WATER TREATMENT TECHNOLOGIES

APPENDIX H
ADVANCED WASTE WATER TREATMENT TECHNOLOGIES

Reverse Osmosis

Reverse Osmosis (RO) utilizes pressure to force water through a semi-permeable membrane which is impermeable to salts. Pressure is continually applied to the feed stream, while product water (permeate) and brine (reject) are continuously withdrawn. Dissolved solids which are rejected by membrane are continuously flushed from the system in the reject stream.

The membranes operate continuously and regeneration is not required. Salt rejection varies depending on the constituent of concern but is typically greater than 95%.

The advantage of this arrangement is the continuous operation of the RO system as a "roughing" demineralizer, and the ability of the RO system to more effectively remove organics and colloids.

Disadvantages of this system include a relatively high capital cost and potential membrane fouling. Typically RO systems are most economical for the treatment of high Total Dissolved Solids (TDS) waters. However, recent improvements in membrane designs have made RO based systems more competitive for treatment of lower TDS waters. The high capital cost can be offset by lower operating costs resulting in a favourable total evaluated cost. Potential membrane fouling can be minimized or avoided by proper design operation, and maintenance of pretreatment system components.

RO, in conjunction with other processes, has been used extensively in the electronics industry where water quality requirements are extremely stringent. It has also been successfully applied in other industries, including the electric utility industry, and is considered a technically and economically viable alternative for use in the APC industries.

APPENDIX H
ADVANCED WASTE WATER TREATMENT TECHNOLOGIES

Electrodialysis Reversal

Electrodialysis Reversal (EDR) is an electrochemical demineralization technique in which ions are transferred from a less concentrated to a more concentrated solution as a result of the flow of direct electrical current and the use of ion exchange membranes. Anion and cation exchange membranes are alternately stacked and placed between an anode and a cathode. Anion exchange membranes allow the passage of anions but repel cations. Likewise, cation exchange membranes allow the passage of cations but repel anions. When a direct electrical current is applied, anions are attracted to the anode and cations to the cathode. The sandwiching of anion and cation transfer membranes between the electrodes effectively forms alternate passageways of demineralized and concentrated solutions which are manifolded in each membrane stack.

EDR utilizes the polarity reversal of the electrodes at regular intervals for a fixed period of time such that a compartment which was a demineralizing compartment becomes a concentrating compartment and vice versa. In this manner, degradation of system performance is avoided by redissolving and removing compounds that have precipitated and formed scale on membrane surfaces.

EDR plants typically remove 90 to 95 percent of the dissolved solids in the influent while operating at a recovery of 75 to 90 percent. EDR, like RO, is typically used for roughing demineralization and is adequate to produce the required APC industries water quality.

The advantages of EDR are similar to that of RO, continuous operation as a roughing demineralizer. Also, since water does not pass through the membrane, they are less sensitive to fouling than RO systems.

Disadvantages include a relatively high capital cost and, unlike RO, EDR will not remove organics, colloidal silica, and will have a lower

APPENDIX H
ADVANCED WASTE WATER TREATMENT TECHNOLOGIES

removal efficiency for dissolved silica. EDR like RO, is most economical for treatment of high TDS waters and high capital costs can be offset by lower operating costs. However, based on past experience it is also considered to be an economically viable alternative for the APC industries.

Continuous Deionization

Continuous deionization (CDI) is a relatively new process which utilizes electrochemical demineralization similar to EDR. CDI modules also utilize alternating cation and anion exchange membranes placed between electrodes forming alternate compartments of demineralized and concentrated solution. However, unlike EDR, alternating diluting compartments contain mixed cation and anion resins which increase the conductivity of the diluting water compartments and enhance the transfer of dissolved solids from the diluting compartments to the concentrating compartments. Also, the application of direct current in excess of that required to transport ions splits the water molecule into hydrogen and hydroxyl ions which have a regenerating effect on the resin.

The primary advantage of the CDI system is its potential to produce high purity water without the use of companion ion exchange equipment and the use of regenerant chemicals.

The advantages of the CDI system are that it can produce the water quality required without the need for additional ion exchange components (e.g. mixed beds) and eliminates the need for regenerant chemicals. It has been successfully used in a variety of industries at low flow rates.

The disadvantages are no economy of scale for either the RO or CDI units resulting in a high capital cost and the lack of experience in high flow, high purity, applications. CDI is most economical in applications treating relatively low flow, high TDS waters.

APPENDIX I

GLOSSARY

APPENDIX I

GLOSSARY

APC	Adhesives and Paints & Coatings
CAM	Computer Aided Manufacture
CCME	Canadian Council of Ministers of the Environment
CCPA	Canadian Chemical Producers Association
CPCA	Canadian Paint & Coatings Association
DCS	Distributed Control Systems
EPA	US Environmental Protection Agency
FTA	Free Trade Agreement
IC	Industry Canada
IESP	Industrial Energy Services Program
ISTC	Industry Science & Technology Canada (now Industry Canada)
MEDT	Ministry of Economic Development and Trade
MOEE	Ministry of Environment and Energy
NAFT	North American Free Trade Agreement
S&A	Shapiro and Associates
SME	Small and Medium Size Enterprises
SPC	Statistical Process Control
SQC	Statistical Quality Control
SWCL	Stone & Webster Canada Limited
TQM	Total Quality Management
VOC	Volatile Organic Compounds

